

BIO – DATA

of **Prof. Sankara Raman Sankaranarayanan** (October 6 2014) (16 pages)

(a.k.a. S. Raman Sankaranarayanan)

Professor, Dept. of Metallurgical and Materials Engineering (MME)

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1. AREAS OF INTEREST:

Process Metallurgy (Ferrous), Process Modeling, Quality Management

2. EDUCATION:

B.E. (Metallurgical Engineering) P.S.G. College of Technology, Coimbatore, India

M.S. (Materials Engineering) Drexel University, Philadelphia, U.S.A.

Ph. D. (Area: Ferrous Process Metallurgy) (Advisor: Prof. Diran Apelian)

Drexel University, Philadelphia, U.S.A.

Doctoral Thesis: Crystallization and related phenomena in mould powders used for continuous casting of steels; (project had significant interaction with the steel industry)

3. EXPERIENCE:

o Post - Graduate Research: 5.5 years (Grad. School, including one year in industry)

(Drexel University, with Prof. Diran Apelian)

(Prof. DA is now the Alcoa – Howmet Chair Professor in WPI, USA)

worked on mould powders (slags) used in the continuous casting of steels; performed high – temperature experiments related to the measurement of fusion rate and measurement of viscosity; performed differential thermal analysis studies; worked with industry, observing caster operations, and then analyzing the performance of mould powders in steel plants; performed theoretical interpretations of powder / slag composition, slag structure and crystallization behaviour;

o Post - Doctoral Research: 1 year (Carnegie Mellon University, with Prof. Alan Cramb)

(Prof. Cramb was earlier the POSCO Chair Professor in CMU; and is now an endowed Chair and Provost in IIT Chicago, USA)

worked on mould simulator project sponsored by U S Steel; moved on from concept of mould simulator to a working mould simulator; enabled instrumented control of mould movement in steel bath; performed experiments with relatively low temperature systems to confirm the feasibility of the simulator; performed preliminary experiments with liquid steel and slag (mould powder) to ensure that the simulator simulates many aspects of actual process, and to confirm the infiltration of slag into the mould – shell gap; performed high temperature experiments for measurement of contact angle between steel and slag;

o Industrial Experience : 3.5 years

(Natco; Inland Steel; Allegheny Ludlum – for part of Doctoral research)

(Later: Ajay Metachem, Sunflag Iron and Steel, Rescon Stollberg)

Natco International / Atlantic Metals, Philadelphia: Research Associate –

worked on design and preparation of mould powder formulations for developmental purposes; worked on calibration of X-ray Fluorescence unit; performed experiments to study the behaviour of formulations;

Inland Steel Research Laboratories, East Chicago: Research Trainee –

worked on experiments using the continuous casting mould simulator; conducted preliminary experiments on different approaches to study the thermal behaviour of mould powders; assisted in ongoing work on viscosity measurement; contributed to studies on thermal analysis of mould powders;

Allegheny Ludlum, Brackenridge: Metallurgical Engineering Intern –

conducted studies in the production plant on the interaction between mould powders and stainless steels, during continuous casting; worked on laboratory experiments to study steel – slag interactions; worked on mould powder related problems in Titanium stabilized stainless steels;

Ajay Metachem, Pune, India: Senior Metallurgist –

played a critical role in the development of indigenous supplies of mould powders for continuous casting; performed developmental work on powder formulations; provided technical service to customers such as Vizag Steel Plant, Visakhapatnam and VISL, Bhadrawati to enhance the performance of mould powders; assisted in efforts exploring the export of mould powders; provided training to personnel in sales and technical services; contributed to improvements in quality in the production of mould powders and in improvised testing of mould powders;

Sunflag Iron and Steel, near Nagpur: Deputy Manager –

performed certain activities in Production Planning and Control, reporting to the DGM PPC; performed certain activities in technical development, reporting to the Executive Director of the plant; streamlined despatch of export consignments, meant for customers in Japan, Thailand and Germany; interacted with SGS; performed quality audit on finished products, for minimizing mix – up of different section sizes; studied certain production problems in continuous casting, for control of critical elements; visited customers in auto component sector to understand problems in performance of products; formulated developmental plans to enhance the quality and performance of products;

Rescon Stollberg: (Head Technical Services – designate) –

played a critical role in the technical aspects of the then proposed joint venture between Rescon, Kolkatta and Stollberg, Germany towards the establishment of a production unit in India; visited existing and potential customers (steel plants); formulated technical details related to proposed production unit and related to proposed laboratory facilities; visited potential sources of Indian raw materials;

o Teaching Experience: seventeen (17) years

Crescent Engineering College, Chennai (Madras): one academic year –

taught course (subject) on basic mechanical engineering; assisted in activities related to metallurgical laboratory; taught course on quality control and reliability; taught part of a course on engineering materials; initiated efforts to teach metallurgy related electives for students of mechanical engineering;

Regional Engineering College, Tiruchirappalli / National Institute of Technology, Tiruchirappalli:

(since July 1998) (present employer)

(Assistant Professor, in NIT Trichy: July 1998 – Dec. 2005)

(NIT Trichy hierarchy: “until 2005” Lecturer– Sr. Lecturer– Assistant Professor– Professor)

(Associate Professor, in NIT Trichy, January 2006 – April 2012; after cadre restructuring)

(NIT Trichy hierarchy: “from 2006” Assistant Professor– Associate Professor - Professor)

(Professor, in NIT Trichy, since April 2012; possibly with retrospective effect from July 2009)

Teaching courses in Metallurgical and Materials Engineering; during 1998 – 2006, taught a wide range of courses (subjects) given the limited strength of permanent faculty and high turnover in “temporary faculty”; taught possibly two-thirds of all MME core courses (considering both UG and PG) as in prevalent curricula; taught possibly six different MME electives to students of MME and other departments; since 2006, trying to focus on certain courses; designed, few years ago, an UG core course on iron making and steel making, replacing more than two and a half courses of earlier times; designed elective courses related to process metallurgy and quality management, at the UG and PG levels; introduced courses *in the context of suggestions from Ministry of Steel* to offer new courses related to steel industry; teaching a global elective on quality management, UG, which has become popular amongst students of different departments; introduced an elective course on product development, with the encouragement of Director NITT and with support from TCS and NASSCOM

Assisting in many academic activities, at different times (such as coordinating of MS and PhD admissions in MME, coordinating QIP MTEch and QIP PhD admissions in MME; compiling departmental data for different types of official reports;); assisting in co-curricular activities (such as Mettle); encouraging

students to take part in competitions, competitive examinations; counseling some students in career planning; guiding student projects; performing research / consultancy projects;

Assisted the Institute in the management of academic activities, as Associate Dean (Academic – PG) for one year; (by formulating many guidelines and streamlining the academic calendar related to PG programmes;)

Assisted the Institute, in critical administrative / legal matters as the Nodal Officer (Legal Cell) for one and a half years; (by following up cases in the Honourable courts of law; meetings with counsel for NIT Trichy and with legal officers of the Government of India (such as the Additional Solicitor General) and with senior officials of the Ministry of Human Resources Development; played a key role in the drafting of affidavits; on one occasion, appeared in person and presented NITT's arguments before the Hon. Bench)

Assisting the Institute, in the lead role of Head, Dept. of MME ((two year term) since January 30, 2012; (now on extension)), heading the department which has a dozen permanent faculty (against twenty three approved faculty posts), some temporary faculty, two INAE Distinguished Visiting Professors and nearly four hundred students; motivating the students in academic and co-curricular activities; enhancing the extent of interaction with industry; leading a massive Rupees twelve Crore (US\$ two million) modernization plan for the department during 2012 – 2014; enhancing the visibility of the department; and improving follow up with agencies such as the Ministry of Steel; coordinated (as in a sponsored project) activities related to (student) steel scholarships and contributed to Institutional efforts for the selection of Ministry of Steel Chair Professor in MME; and ensuring increased offers of jobs from steel industry, for the graduating students; and initiating efforts towards bringing in Adjunct Faculty and Visiting Faculty, thereby increasing the footfall of experts in the department; organizing series of technical lectures by experts, for the Golden Jubilee (NITT) celebrations, starting July 2013; working closely with the Trichy Chapter of the Indian Institute of Metals; successfully led the departmental efforts for accreditation documentation for BTech (MME) programme; and successfully led the departmental efforts during visit by team of NBA experts for accreditation (evaluation) of BTech (MME), during April 2014; (result awaited); leading the departmental efforts for accreditation documentation for three MTech (MME) programmes;

4. RESEARCH ACTIVITIES:

Process Metallurgy: Ph.D. student (second in sequence) joined in August 2010, to work in process metallurgy / electro metallurgy; expected to submit Thesis by December 2014; some experiments performed using facilities at the Central Electrochemical Research Institute, Karaikudi; two more students joined within the last three years, with one working on continuous casting slags, and the other working on the utilization of metallurgical wastes (this student discontinued after getting appointment in Government Polytechnic Service); initiated interaction with SSP SAIL Salem, an alloy steel plant, for the two recent students; also collaborating with a Professor (in MME) in Powder Metallurgy, in the context of work in progress by his PhD student;

Guided nearly twenty M. Tech. projects in areas such as process metallurgy, process modeling, utilization of wastes, welding engineering; synthesis of materials; and NDT;

Guided nearly thirty B. Tech. projects in areas such as process modeling, foundry, quality management

Was Principal Investigator for MHRD Thrust area project on "Spectroscopic and structural analysis of slags used in steelmaking and continuous casting", 2001 – 2004, vide F. 27 – 6 / 2000 TS V dated March 28, 2001, project value of Rupees Eight Lakhs;

Was Principal Investigator for MHRD MODROBS project on "Establishment of Process Modeling Laboratory", 2001 – 2004, project value of Rupees Five Lakhs;

Completed a research based industrial consultancy project on "Technical Analysis and Optimization of continuous casting", for an integrated steel plant located in Visakhapatnam (Project started in Oct. 2007; technical report submitted in June 2009), vide fax work order awarded October 1 2007, project value of Rupees Two Lakhs and Forty thousand plus service tax (project cited in the Annual Report/s of the Ministry of Steel (indicating University – steel industry interaction in the country));

Worked on a research based industrial consultancy project on "Fundamental studies on BOF (steelmaking) slags", for an integrated steel plant located in Jamshedpur, vide work order dated July 14 2005, project value of about Rupees Three Lakhs and Fifty Three Thousand, related to quality of liquid steel;

(Proposal submitted to a National funding agency, early 2014, jointly with CARE Engineering College Trichy, for research on thermodynamic modeling)

Played a key role in procurement and installation of technical software in process metallurgy (thermodynamic calculations, solidification processing and welding), in this department

Played a key role in introducing a laboratory course on Process Metallurgy, along with Dr S P Kumaresh Babu (MME), for BTech (MME) students

Played a key role in procurement and installation of experimental facilities / equipment such as high temperature furnaces, vacuum induction melting furnace; along with Dr S P Kumaresh Babu (MME)

Initiated a working group / task force towards the development of a Centre of Excellence in Steel, in NITT, with encouragement of Director; and with support of faculty (Dr S P Kumaresh Babu (MME), Dr N Anantharaman (Chem Engg) and Dr A K Bakthavatsalam (T&P))

Quality Management: Initiated work on Cost of Quality (with industrial orientation); PhD student (first in sequence), under QIP scheme, joined in 2006, submitted PhD Thesis in October 2009 and graduated in 2010; fresh approach towards monetization of process failures in steel plant activities; student and self interacted with two steel plants, during the course of this work;

Was Principal Investigator for a research based industrial consultancy project (2002 – 2003), on Quality improvement and cost reduction in die casting, for a leading non-ferrous foundry in Coimbatore; controlled the variability in product quality and ensured quick return on quality related efforts;

5. TEACHING ACTIVITIES:

(Background: Each three credit course (subject), here, has three actual lecture sessions per week, amounting to about forty lectures during the semester) (Institute indicative teaching load: 3 courses / 9 credits per year) (Self: **Heavy teaching load**; teaching 4 - 5 courses (12 – 15 credits) per year)

Example:

(Odd semester of 2010 – 2011: taught two courses, eight sessions per week (8 credits); and with responsibility for tests and exams for one more UG course);

(Even semester of 2010 – 2011: taught three courses, nine sessions per week, including one newly introduced course; PhD student assisted in one half of one course)

(Even semester of 2012 – 2013: taught three theory courses, nine sessions per week; and had responsibility for half of a newly introduced laboratory course; and PhD students assisted in one third of one course)

(Even semester of 2013 – 2014: associated with three theory courses; and had responsibility for half of a laboratory course; out of which taught global elective course on quality management, to a class of more than three hundred students, with students attending from two class rooms, with suitable video casting, for some sessions; coordinated a newly introduced global elective on 'New Product Development', with many lectures delivered by TCS and (self) fully in charge of testing and valuation; taught part of an elective on ladle metallurgy and continuous casting, with inputs from Dr S P Kumaresh Babu (MME)

Courses (subjects) taught over the past few years:

B. Tech.: **Iron making and Steel making** (Core) (course details in NITT website)

Transport Phenomena (Core)

Process Modeling and Applications (Elective) (with some hands on experiments)

Introduction to Quality Management (Global Elective)

Metallurgical Thermodynamics (Core)

Ladle Metallurgy and Continuous Casting (Elective)

(associated with) **New Product Development** (Elective)

Process Metallurgy (Laboratory course)

M. Tech.: Metallurgical Thermodynamics (Core)

Statistical Quality Control and Management (Elective)

Testing, Inspection and Quality Control (Elective)

Developments in iron making and steel making (Elective)

6. TRAINING PROGRAMMES ATTENDED (as a trainee):

Examples: In the following areas: Fine ceramics (IIT Bombay), Alumina Technology (JNARDDC Nagpur), Six Sigma (IIM Kozhikode), Tracer studies (NITTTR Madras), Preparing for challenges ahead (ASCI Hyderabad, at Trichy); ThermoCalc User group meeting (Hyderabad, 2013);

7. TRAINING PROGRAMMES CONDUCTED (as a trainer):

Delivered lectures / served as one of the coordinators, in some training programmes offered by Dept. MME NITT / Indian Institute of Metals Trichy Chapter, on topics / areas related to metals and materials

Associated with training programmes / seminars organized by the CECASE (Centre of Excellence in Corrosion and Surface Engineering), working with Dr S Natarajan and Dr S P Kumaresh Babu

Served as a lead speaker (and departmental coordinator), on multiple topics related to metals, esp. steels, in a customized training programme on metals and materials, for a group of scientists at DRDL, Hyderabad (2012); played a key role in the planning and implementation of this training programme

Served as the trainer, for half day technical training programme, on quality issues related to continuous casting of stainless steels, Salem Steel Plant (SSP SAIL), Salem, March 2013

Initiated and conducted three short term training programmes (continuous casting; slags in steel plant operations; iron making and steel making) during academic year 2012 – 2013, targeting engineers from steel industry; with support from three faculty of Dept. MME NITT; and registered participation from steel plants representing nearly thirty percent of Indian steel production

Served as co-coordinator, for one day training programme in welding (Feb. 2014), working with Dr S Muthukumaran (MME)

8. RECENT PAPER PRESENTATIONS / INVITED LECTURES:

B. Gururaj, S. Raman Sankaranarayanan, "Analysis of Continuous Casting Slags by Optical Basicity Calculations", Abstract Accepted for Presentation in the VI International Conference on Slags, Fluxes and Molten Salts, held in Sweden and Finland, June 2000 (but could not attend)

S. Raman Sankaranarayanan, "Role of Process Modeling in Hydrometallurgy", presented in the National Seminar on Hydro (Solvo) Thermal Syntheses and Applications, M.S. University, Tirunelveli, January 24 - 25, 2002

S. Raman Sankaranarayanan, "Thermodynamic and Kinetic Aspects of Hydrometallurgy", an invited talk, delivered in the National Seminar on Hydro (Solvo) Thermal Syntheses and Applications, M.S. University, Tirunelveli, January 24 - 25, 2002

S. Raman Sankaranarayanan, "Role of slags in melting and casting - some recent developments", presented in the National Conference on Processing of Metals, P.S.G. College of Technology, Coimbatore, January 31 - February 1, 2002

M. Kumar, S. Raman Sankaranarayanan, "Effect of optical basicity on the viscosity of slags", presented (by MK) in the National Symposium of Research Scholars NSRS - 4, IIT Madras, September 2002

T. Sowmya, S. Raman Sankaranarayanan, "Structural analysis of slags by spectroscopy", presented in the NMD - ATM 2002, Indian Institute of Metals, Baroda, November 14 - 17, 2002

S. Raman Sankaranarayanan, "Analysis of slag performance by different chemical parameters", presented in the NMD - ATM 2002, Indian Institute of Metals, Baroda, November 14 - 17, 2002

K. Santhy, S. Raman Sankaranarayanan, "Application of Oxygen to Silicon ratio to the viscosity of slags" presented in the Seminar on "Science and Technology of Advanced Engineering Materials" STAEM 2003, The Indian Institute of Metals, Trivandrum, February 2003

P. Venkatachalam, B. Suresh, T. Sowmya, S. Raman Sankaranarayanan, "Materials Processing – Utilization of Metallurgical Wastes", paper presented (by TS) in The National Conference on Material Processing and Failure Analysis (MPFA-2003), held at Regional Engineering College, Tiruchirappalli, June 2003

S. Raman Sankaranarayanan, "Interesting developments in electric steel making", paper presented in the National Seminar FAEST 2003, held at CECRI Karaikudi, July 23 – 24 2003

S. Raman Sankaranarayanan, K. Murthy (Roots Cast), "Quality Improvement efforts in metal casting – A case study", paper presented in The Second National Conference on Quality in Metallurgical Industries, held at PSG College of Technology, Coimbatore, Dec. 5 – 6, 2003 and published in the refereed Conference Proceedings

(Paper accepted, but could NOT attend) T. Sowmya, S. Raman Sankaranarayanan, "Spectroscopic analysis of slags – preliminary observations", accepted for presentation (and published in the refereed conference proceedings) in the VII International Conference on Molten Slags, Fluxes and Salts, held in South Africa, January 2004, pp. 693 – 697; this paper has been cited by other researchers

R. John Felix Kumar, S. Raman Sankaranarayanan, "Value added oxides from metallurgical wastes", paper presented in the 42nd National Metallurgists Day – 58th Annual Technical Meeting of the Indian Institute of Metals, held at Thiruvananthapuram, November 17 – 19 2004

L. Gopinath, P. Angayarkumari, S. Raman Sankaranarayanan, "Temperature distribution in CC mould with different immersion levels of Submerged Entry Nozzle", poster presented in the 43rd National Metallurgists Day – 59th Annual Technical Meeting of the Indian Institute of Metals, held at IIT Madras, November 14 – 16 2005

S. Raman Sankaranarayanan, "Thermodynamic Modeling – A Teacher's Perspective", an invited talk delivered in the ThermoCalc (of Sweden) Seminar, held in Hyderabad, February 2007

S. Raman Sankaranarayanan, "Introduction to Chemical Modeling," an invited talk delivered in NITK, Surathkal, under the auspices of TEQIP Networking programme, March 15, 2007

S. Raman Sankaranarayanan, "Automotive Steels – Recent Trends", an invited talk delivered in the Workshop on Automotive Materials, Annamalai University, held at Chidambaram, April 7 2007

S. Raman Sankaranarayanan, "Opportunities in Metallurgical and Materials Engineering", a lecture delivered for school students, in the programme organized (by SRS) MME / TEQIP and IIM Trichy, held at NIT Trichy, August 19 2007 (similar lecture being delivered, during subsequent years, with help from NITT students and IIM)

S. Raman Sankaranarayanan, "Metallurgy of Stainless Steels – an introduction", an invited talk delivered in "SIMI 2007", organized by Salem Steel Plant and IIM Salem, held at Salem, Oct 26 2007

S. Raman Sankaranarayanan, "Recent Trends in Modeling", an invited talk delivered in the National Conference on Emerging Materials and Technologies for India 2020, (EMT 2020), organized by Dept. MME, NIT Trichy, January 24 – 25 2008

Peri Reddy. V., S. Raman Sankaranarayanan, "Thermodynamic assessment of oxide systems", paper presented (by PR) in EMT 2020, held at NIT Trichy, January 2008

Mohandas. V. P., S. Raman Sankaranarayanan, "Cost of Quality: a tool for quality improvement and process improvement", paper presented in EMT 2020, held at NIT Trichy, January 2008

S. Raman Sankaranarayanan, "The World of Materials", an invited talk delivered on the occasion of the inauguration of IIM Student Chapter, Jayaram College, Tiruchirappalli, January 24 2008

D. Arun and S. Raman Sankaranarayanan, "Numerical simulation of heat flow in stainless steels welded by GTAW process", paper presented (by DA) in the International Welding Symposium IWS 2K8, held in New Delhi, February 2008; and published in the refereed conference proceedings

S. Raman Sankaranarayanan, "Overview of Modeling", a lecture delivered in the AICTE sponsored Training programme organized by Dept. MME, NIT Trichy, February 2008

S. Raman Sankaranarayanan, "Finite Element Analysis: Applications in metallurgical processes", an invited talk delivered in the Workshop on "Finite Element Analysis: Concepts and Applications", held in VIT, May 29 2008

D. Arun, S. Raman Sankaranarayanan, "Computational prediction of delta ferrite content and comparison with experimental measurements", presented (by DA) in SOJOM 2008, an international welding symposium on the joining of materials, held in BHEL Tiruchirappalli campus, Dec. 11 – 13, 2008; and published in the conference proceedings

S. Raman Sankaranarayanan, "Modeling of microstructural features in welding", lecture delivered (January 7, 2009) in the AICTE – MHRD sponsored Staff Development Programme on "Recent advances in modeling and simulation of joining of materials", organized by Dept. of Mech. Engg., NIT Trichy, during Dec. 29, 2008 – January 10, 2009

S. Raman Sankaranarayanan, "Steels: Alloying and related concepts", lecture delivered in the one day training programme on "Metallurgy and metallographic practice", conducted by the Indian Institute of Metals, Tiruchirappalli Chapter, for technical staff and engineers, January 19 2009, in Tiruchirappalli

S. Raman Sankaranarayanan, "Classification of Engineering Materials", lecture delivered in the one week (Feb. 2 – 8, 2009) training programme on "Heat Treatment: processes, techniques and applications", conducted by the Indian Institute of Metals, Tiruchirappalli Chapter, for engineers, technical staff and students, February 2 2009, in Tiruchirappalli

A.V. Krishna Murthy and Sankara Raman Sankaranarayanan, "Thermodynamic study on the precipitation in Titanium stabilized stainless steels", presented in the International Conference on the Advances in Theory of Ironmaking and Steelmaking (ATIS 2009), held in IISc, Bangalore, during Dec. 9-11, 2009; and published in the refereed conference proceedings

Debrup Ghosh, A.V. Krishna Murthy and Sankara Raman Sankaranarayanan, "Application of Optical Basicity to viscosity of high alumina blast furnace slags", poster presented (by DG) in ATIS 2009, held in IISc, during Dec. 9 – 11, 2009

Mohandas. V.P. and Sankara Raman Sankaranarayanan, “A Cost of Quality Model for steel plant activities”, presented (by MDVP) in the International Conference on latest trends in Simulation Modeling and Analysis (COSMA 2009), held in NIT Calicut, during Dec. 17 – 19, 2009; and published in the refereed conference proceedings

Akula Durga Vara Prasad (M.Tech. project student) and Sankara Raman Sankaranarayanan, “Studies on solidification of Boron containing alloy steels via thermodynamic modeling”, presented (by Prasad) in CROME 2010, a National Students Symposium on Materials and their Processing, conducted by IIM Tiruchirappalli, March 2010; and published in the conference proceedings

Akula Durga Vara Prasad (M.Tech. project student) and Sankara Raman Sankaranarayanan, “Thermodynamic Modeling of deoxidation products and inclusion chemistry in Mn / Si killed tire cord steel”, accepted for presentation in the 15th International Metallurgy and Materials Congress (IMMC 15), being held in Istanbul, Turkey (Nov. 2010); and the full text manuscript accepted for publication in the refereed conference proceedings; but could not attend the conference

Sankara Raman Sankaranarayanan, “Performance of mould slag in continuous casting of steels”, an invited talk delivered at CARE School of Engineering, Tiruchirappalli, July 2012

Sankara Raman Sankaranarayanan, “Alumina pick up by mould slag during continuous casting of steels”, a technical talk delivered at JSW (steel plant) Toranagallu (and IIM Vijayanagar chapter), July 2012

Sankara Raman Sankaranarayanan, “Developments in Indian steel industry”, an invited talk delivered at JJ College of Engineering, Tiruchirappalli, August 2012

Attended Group meeting at a Defence establishment, on the use of thermodynamic modeling for the development of advanced materials for strategic applications, 2012

Sankara Raman Sankaranarayanan, “Recent Developments in steels”, an invited talk delivered at a training programme conducted by SKCE, Karur, June 2013

Sankara Raman Sankaranarayanan, “Metallurgical aspects of Boiler quality tubes: an introduction”, an invited talk delivered at a workshop on boiler tube failures, organized by the Institution of Engineers (I) Tiruchirappalli, March 2014

Sankara Raman Sankaranarayanan, “Opportunities and Challenges in Steel industry”, an invited talk delivered at PSG College of Technology, Coimbatore, June 20 2014

(and some undated Invited talks delivered in Salem Steel Plant, Vizag Steel Plant and IE Tiruchirappalli)

(some conference papers presented by MTech / PhD students of my team, during 2012 – 2014, yet to be updated here)

9. RECENT JOURNAL PUBLICATIONS:

(i) K. Santhy (M. Tech. project student) (now: faculty in CARE Trichy), T. Sowmya (MHRD Project Research Assistant), Sankara Raman Sankaranarayanan, “**Effect of Oxygen to Silicon ratio on the viscosity of metallurgical slags,**” ISIJ International, vol. 5, 2005, no. 7, pp. 1014 – 1018

(ii) L. Gopinath (M. Tech. project student) (now: scientist in CSIR), P. Angayarkumari (Research Assistant / DST Project Investigator) (now: faculty in Gulf region), Sankara Raman Sankaranarayanan, “**Extent of Solidification varying the depths of immersion of SEN in continuous casting**,” Steel Grips, vol. 5, n 2, 2007, pp. 127 – 130

(iii) Peri Reddy. V. (M. Tech. project student) (now: with JSW Steel plant, Salem), Sankara Raman Sankaranarayanan, “**Prediction of alumina pick up by continuous casting mould slags**”, Stahl und Eisen, vol. 128, n 6, June 2008, pp. 41 – 45

(iv) Arun. D. (M. Tech. project student), Sankara Raman Sankaranarayanan, “**Prediction of heat flow in stainless steels welded by GTAW process using Hydrogen – Argon mixture**”, Accepted (March 2008) for publication in Journal of the Indian Welding Society; published later

(v) Y.A.A. Murali Krishna (M. Tech. project student), T. Sowmya (MHRD Project Research Assistant), Sankara Raman Sankaranarayanan, “**Application of optical basicity parameter to foaming of slags**”, La Metallurgia Italiana, October 2008, pp. 51 - 54

(vi) M. Kumar (M. Tech. project student) (now: faculty in CARE Trichy), Sankara Raman Sankaranarayanan, “**Effect of optical basicity on the viscosity of oxide systems**,” Journal of Mining and Metallurgy, vol. 44, no. 1, section B (Metallurgy), 2008, pp. 133 – 135; (Rapid Communications; called as Letters to Editor, by this journal)

(vii) Mohandas. V.P. (Ph. D. student) (now: faculty in Govt. Engineering College, Kerala), Sankara Raman Sankaranarayanan, “**Cost of Quality analysis: Driving bottom line performance**”, International Journal of Strategic Cost Management, Vol. 3, no. 2, Winter 2008, eight pages

(viii) Peri Reddy. V., Sankara Raman Sankaranarayanan, “**Alumina pick up by mould slag during continuous casting of steels**”, presented in the Fourth International Conference on Continuous Casting of Steel in Developing Countries, The Chinese Society for Metals, Beijing, China, Nov. 4-7, 2008; and published in the refereed conference proceedings / supplement to the Journal of Iron and Steel Research International, vol. 15, supplement 1, October 2008, pp. 737 – 741; (some overlap with the paper published in Stahl und Eisen)

(ix) Peri Reddy. V., Sankara Raman Sankaranarayanan, “**Thermodynamic modeling as a strategy for casting highly alloyed steels**”, Journal of Iron and Steel Research International, vol. 16, no. 5, Sept. 2009, pp. 29 - 31

(x) B. Suresh (M. Tech. project student), T. Sowmya, Sankara Raman Sankaranarayanan, “**Synthesis of iron oxide from metallurgical wastes**”, Journal of Mining and Metallurgy, vol. 45 (1), sec. B, 2009, pp. 127 – 130

(xi) Mohandas. V. P., Sankara Raman Sankaranarayanan, “**CoQ, a strategic tool in decision-making**”, Steel Grips, web p. 252 (– 254), vol. 7, n. 4, 2009, in the Products and Quality issue

(xii) Mohandas. V.P., Sankara Raman Sankaranarayanan, “**Statistical and Metallurgical Analysis of process interruptions in continuous casting of steels**”, Journal of Mining and Metallurgy, vol. 46 (1), Sec. B, 2010, pp. 113 – 116

(xiii) D. Ghosh (B. Tech. project student) (now: pursuing higher studies in the USA), V.A. Krishnamurthy (M.Tech. project student), Sankara Raman Sankaranarayanan, “**Application of optical basicity to**

viscosity of high alumina blast furnace slags", Journal of Mining and Metallurgy, vol. 46 (1), Sec. B, 2010, pp. 41 – 49

(xiv) A.D. Prasad (M. Tech. project student) (joined Indian steel industry) and Sankara Raman Sankaranarayanan, "**Studies on solidification of Boron containing alloy steels via thermodynamic modeling**", Steel Grips, vol. 8, 2010, p.45 - 48

(xv) A.D.V. Prasad and Sankara Raman Sankaranarayanan, "**Thermodynamic modeling of de-oxidation products and inclusion chemistry in Mn-Si killed tire-cord steel**", Journal of Mining and Metallurgy, vol. 48 (1), Sec. B, 2012, pp. 45 – 51

(xvi) M. Ilayaraja (Ph.D. student), L. John Berchmans (CSIR CECRI Karaikudi), Sankara Raman Sankaranarayanan, "**Preparation of rare earth – transition metal intermetallic compounds by calciothermic reduction diffusion process**", Metallurgical and Materials Engineering, vol. 20, n 1, 2014, pp. 35 – 40

(Two manuscripts, in electro – pyro metallurgy, numbered and under formal review in journals, 2014)

10. CITATIONS of research papers from Raman's Group, by peers:

(as noted in open web resources) (examples only listed here)

a. **Sankara Raman Sankaranarayanan** (and Diran Apelian), "Evaluation of mould powder performance via crystallization analysis", in the Proceedings of the 75th Steelmaking Conference (**1992**), Toronto, Canada, Iron and Steel Society, Pa., pp. 607 – 625: **cited by S. Seetharaman (Carnegie Mellon University)** in Chapter II, "Pertinent properties of metals and slags in continuous casting", in Making, Shaping and Treating of Steel, 11th ed., AISE **2003**

b. Sankara Raman Sankaranarayanan (and Diran Apelian), "Evaluation of mould powder performance", 1992: also **cited by Shu Jun et al**, in "Crystallization temperature of continuous casting mould fluxes", Journal of University of Science and Technology Beijing, **2000**, 22 (6)

c. Sankara Raman Sankaranarayanan (and Diran Apelian), "Evaluation of mould powder performance", 1992: also **cited by Ya Meng, PhD Dissertation**, "Modeling interfacial slag layer phenomena in the shell mold gap in continuous casting of steel", University of Illinois at Urbana Champaign USA, **2004**

d. Sankara Raman Sankaranarayanan (and Diran Apelian), "Evaluation of mould powder performance", 1992: also **cited by Normanton (Corus UK)** et al, Technical Report on Mould powder consumption in continuous casting, contract 7210 – PR / 273, Technical Steel Research, European Commission, **2005**

e. **T. Sowmya, Sankara Raman Sankaranarayanan**, "Spectroscopic analysis of slags – preliminary observations", in the Proceedings of the VII International Conference on Molten Slags, Fluxes and Salts, South Africa, January **2004**, pp. 693 – 697: **cited by C. Navarro et al (Spain)**, "Physico-chemical

characterization of steel slag: study of its behaviour under simulated environmental conditions”, Environ. Sci. Technol., **American Chemical Society**, June **2010**

f. T. Sowmya, Sankara Raman Sankaranarayanan, “Spectroscopic analysis of slags....” **2004**, also **cited by M R Sheikh et al**, Manipur University and IMMT Bhubaneshwar, “Characterization of iron slag of Kakching, Manipur by X-ray and optical spectroscopy”, Indian Journal of pure and applied physics, Vol. 48, sept. **2010**, pp. 632 - 634

g. **Peri Reddy. V., Sankara Raman Sankaranarayanan**, “Prediction of alumina pick up by continuous casting mould slags”, Stahl und Eisen, **2008**: **cited by Daniel d R Silva**, in Master of Engineering Dissertation, Universidade Federal Do Rio Grande Do Sul, (**Brazil?**), Porto Allegre, **2010**

h. **D. Ghosh, V.A. Krishnamurthy, Sankara Raman Sankaranarayanan**, “Application of optical basicity to viscosity of high alumina blast furnace slags”, Journal of Mining and Metallurgy, **2010**: **cited by Sina Mostaghel, Doctoral Thesis**, “Influence of Alumina on the Zinc slag fuming processes”, Lulea University of Technology, (Sweden), November **2012**

i. D. Ghosh, V.A. Krishnamurthy, Sankara Raman Sankaranarayanan, 2010, also **cited by Sanjay Raj**, M Tech (MME) Thesis, “Significance of activation energy in process metallurgy”, **NIT Rourkela**, May **2013**

j. D. Ghosh, V.A. Krishnamurthy, Sankara Raman Sankaranarayanan, 2010, also **cited by N L Ndamka, PhD Thesis**, “Microstructural damage of thermal barrier coatings due to C M A S attack”, Cranfield University, October **2013**

k. D. Ghosh, V.A. Krishnamurthy, Sankara Raman Sankaranarayanan, 2010, also **cited by Bruno Bertelli Ferraro**, ‘...thermo physical properties of CaO SiO₂ Al₂O₃ MgO system...’, Dissertation for Master’s in Engineering, **University of Sao Paulo**, 2014

l. **K. Santhy, T. Sowmya, Sankara Raman Sankaranarayanan**, “Effect of Oxygen to Silicon ratio on the viscosity of metallurgical slags,” ISIJ International, **2005**: cited by **A. Dey (Tata Steel R&D UK)**, “Development of viscosity calculation method for mould powders”, Iron making and Steel making, **2012**

m. K. Santhy, T. Sowmya, Sankara Raman Sankaranarayanan, ISIJ **2005**, also **cited by Kakali Mukherjee** and Swatantra Prakash (**CSIR NML**), “Cold simulation of momentum transfer of a metal droplet falling through slag systems possessing network structured fluids’, Chemical Engineering Science, vol. 66, **2011**, pp. 1027 – 1037

n. **Mohandas V P and Sankara Raman Sankaranarayanan, IJSCM, 2008, cited by A Sailaja (IGNOU New Delhi)** et al, “Cost of Quality models and practices in manufacturing industries: a literature review”, International Journal of Business and Management tomorrow, vol. 2, n 10, Oct. **2012**

11. ADMINISTRATIVE RESPONSIBILITIES: (some details provided in section 3, on experience)

Associate Dean (Academic: PG) – Dec. 2005 to January 2007

Nodal Officer, Legal Cell – Dec. 2010 to July 2012

Head of the Department, Dept. MME, since January 30 2012

12. INTERACTION WITH INDUSTRY:

Formal interaction (sponsored projects): Steel Plants and foundries

Formal interaction (Student projects): WRI - BHEL, GE – JFWTC, JSW, CSIR - NML, CSIR - CECRI

Industrial Internship sponsored by AICTE: June 7 – July 6, 2004, at Roots Cast, Coimbatore

Outreach activities / meetings: with engineering companies outside the steel industry also

13. PARTICIPATION IN PROFESSIONAL SOCIETIES:

Life Member – ISTE – Indian Society for Technical Education

Life Member – IIM – **Indian Institute of Metals** (active in Tiruchirappalli chapter)

Life Member – IWS – Indian Welding Society

Life Member – PMAI – Powder Metallurgy Association of India

Life Member – SBAOI – Society for Biomaterials and Artificial Organs (India)

Joint Secretary, Indian Institute of Metals, Tiruchirappalli Chapter (about four years)

Vice Chairman, Indian Institute of Metals, Tiruchirappalli Chapter (since mid - 2014)

Technical coordinator / Mentor for school teams (from Southern and Central Tamil Nadu) sponsored by IIM Trichy; one or two of these teams **have been winning the First or Second prize in the Nation**, during 2008 - 2014 – in the prestigious Prof. Brahm Prakash Memorial International Quiz on Materials, organized by the Indian Institute of Metals, and typically held in IGCAR Kalpakkam; (with significant inputs from student volunteers of NIT Trichy and volunteers from BHEL Trichy)

One of the editors for the Newsletter of IIM Trichy Chapter, for about two years

Technical coordinator for National Conference organized by IIM Trichy: CROME 2010 and CROME 2011

14. AWARDS AND HONOURS:

(a) National Merit Scholarship, from Govt. of TamilNadu, based on State rank in S.S.L.C. (Std. X) State level public examination

(b) Proficiency Award from PSG College of Technology, Coimbatore, for topping the class in B.E. (Met.)

(c) Admission to Drexel University, Philadelphia, with full assistantship, to cover tuition, fee and living expenses, for higher studies

(d) Elected to Alpha Sigma Mu, the Metals Honour Society, while a student at Drexel University

(e) "IIM MAM Award 2010" for the Best Paper presentation in CROME 2010, conducted by IIM Trichy, March 2010, won by Akula Durga Vara Prasad (M.Tech. project student) for presentation of the paper "Studies on solidification of Boron containing alloy steels via thermodynamic modeling", authored by Akula Durga Vara Prasad and Sankara Raman Sankaranarayanan

(f) "BTTD 2013 Best paper award" for Mohon (M.Tech. project student) (now: with a core engineering company in Hosur), for presentation of the paper on modeling of welding processes, authored by Mohon and Raman; during annual conference "Behind the Teacher's Desk", organized by the National Metallurgical Laboratory, Jamshedpur, April 2013

15. Salient aspects, in the context of **Steel related initiatives** envisaged in NIT Trichy:

- superior **academic background**, in Metallurgical and Materials Engineering
- **international exposure**
- close **interaction with steel industry**, over an extended period
- visited many steel plants in India, over the last ten years, including SSP SAIL Salem, JSW Salem, JSW Toranagallu, Essar Steel, Sunflag Iron and Steel, Vizag Steel Plant and Tata Steel
- worked on projects funded by the steel industry
- (with guidance from the then Chairman Board of Governors NITT) had a meeting with the Director General of the Confederation of Indian Industry at Delhi; and launched an effort for steel industry sponsored consortium at NITT (but did not succeed at that point of time)
- submitted (July 2013) formal "Expression of Interest", for R&D projects at Vizag Steel
- track record in teaching subjects (courses) related to ferrous process metallurgy
- teaching four credit course on **iron making and steel making**
- experience in teaching process modeling elective, with emphasis on applications
- **introduced, and taught, an elective related to steel plant activities, at the MTech level, considering suggestion from the Ministry of Steel** (to have more courses related to steel)
- **introduced, and taught, an elective on Ladle Metallurgy and Continuous Casting of steels, at the BTech level, considering suggestion from the Ministry of Steel** (to have more courses related to steel)
- **introduced**, in the recent academic year, a **laboratory course on process metallurgy**, with inputs from Dr Kumaresh Babu
- known in the field of thermodynamic modeling, as applied to steel plant operations
- **motivated students** to participate in steel / metallurgy related competitions at the national and international level

- **motivated some students** (recipients of prestigious summer internship awards) to work on live projects in the steel industry (steel making and continuous casting) during summer
- **sustained efforts to forge partnerships, in steel related activities**, in India and across the world
- (in my perception) **helped NITT achieve a relatively superior rank in ferrous process metallurgy amongst all Institutes in the country**
- enthusiastic record of projects and publications, within existing resources
- good value of publications, as suggested by citations by leading researchers
- **projecting a positive image for steel**, amongst the student community in NITT and elsewhere
- lecturing extensively, in different colleges, **highlighting the growth and challenges in steel industry**

16. Interaction with other Universities and with the materials community at large

Served, on some occasions, as member of Board of Studies

Served, on some occasions, as external examiner (at different educational levels)

Served, on some occasions, as professional referee for evaluation of project proposals (seeking funds)

Served, on some occasions, as reviewer in reputed journals (evaluating manuscripts)

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