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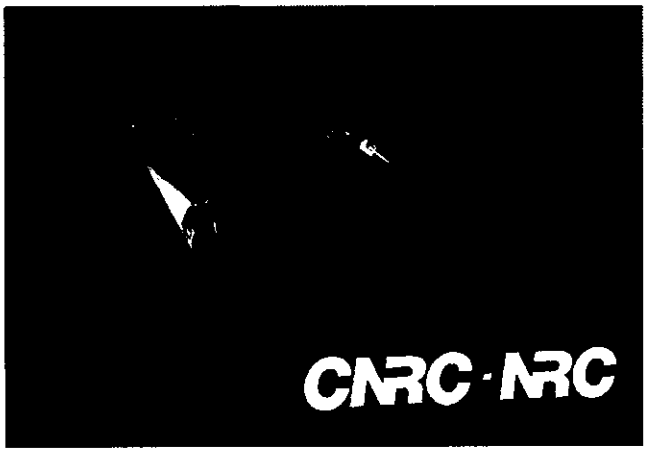

Robert Simha
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Robert Simha participated in the National Research Council Canada, Industrial Materials Institute research activities, as a visitor, resident scientist, collaborator and speaker during the meetings on thermodynamics, polymer blends, composites, foams and nanocomposites. Robert was our advisor, co-author of many publications, inspiration and for the most cherished friend. Thus, to celebrate his 95th birthday, the latest bi-annual nanocomposites meeting at IMI was combined with the dedicated to him ***Symposium on Polymer Physics***, 2008. 10. 17–18. During the symposium he elected to present (see photo) his latest work with Richard Robertson on the "***Volume Relaxation and Lattice-Hole Model***".

Robert was born and educated in Vienna. He obtained his doctorate in theoretical physics (at the age of 23) for the work on "*Contributions to colloid hydrodynamics*". His thesis advisers were Einstein's friends and Robert's early work focused on expanding Einstein's theory of suspension viscosity. The First Chemical Institute at the University of Vienna was created in 1932, with Hermann Mark as the director. One of the research areas dealt with the relationships between solution viscosity and molecular weight. Thus, it was natural that Simha joined Mark's group as a postdoctoral fellow (unpaid!) for the very productive three years. In 1936 Guth and Simha published the theory of hydrodynamic interactions in suspensions. There was the re-derivation of Einstein's equation, 'excursions' with Eirich into kinetic theory, the viscosity of gases, studies of viscosity, surface tension and heats of vaporization for chain molecules, and a review chapter: *Atomphysikalische Grundlagen der Katalyse* for the *Handbuch*. Political events in 1938 resulted in Mark moving to Hawkesbury, Ontario, Fritz Eirich to England, while Guth and Simha departed for the U.S.

At Columbia University Simha obtained Faculty Fellowship that allowed him to choose his research areas. There he extended Einstein's viscosity theory to suspensions of asymmetric, ellipsoids and incorporated the Brownian motion, used for the determination of globular proteins dimensions. With Elliot Montroll Robert developed a general kinetic theory of chain degradation. At that time, he started his teaching carrier with a graduate course on chemical kinetics at Brooklyn College.

In 1941 Robert joined Mark in the Brooklyn Polytechnic Institute, before moving to the Howard University in Washington, DC. In 1944 the National Bureau of Standards (NBS) invited him to give an evening graduate course on kinetic and equilibrium aspects of polymer science, what resulted in Simha joining NBS as a Consultant and Coordinator of Polymer Research. The following six years focused on hydrodynamics and theory of depolymerization capable to account for random scission in linear polymethylene and unzipping process with high monomer recovery in poly(methyl methacrylate).

In 1951 Simha became professor at the New York University, teaching a graduate course on transport processes. There he started his long involvement in the statistical thermodynamics of liquids, applying the cell model to thermodynamic mixtures and equation of state (eos). With his student, Stuart Hadden, he compared the theoretical predictions with data for the linear and branched paraffins. With another student, Jack Zakin, he continued the work on the thermodynamic and viscosimetric aspects of polymer solutions in good and poor solvents, on the concentration scaling of viscosity and on the conformational changes of flexible chains. In 1952 he published highly successful cell theory for the concentration dependent viscosity of hard sphere suspensions. In collaboration with Frisch and Eirich, Simha treated adsorption of long chains from solution.

In 1958 Simha moved to University of Southern California, where as a chairman of the ACS Polymer Group he organized dinner-seminars with prominent speakers, organized and chaired the first Gordon Research Conference, and created a series of memorable summer lectures, with such lecturers as Linus Pauling and Peter Debye. Robert had late evening lectures on the hydrodynamics and viscoelasticity. They were popular due to the clarity and originality of approach. Robert usually started with a recent reprint, followed by derivation of the fundamental relations on which the paper was based. Many listeners, including I. G. Otterness and L. A. Utracki, were deeply stimulated by his lectures. The latter joined Simha in 1961 as a postdoctoral researcher. The topics of mutual interests were: concentration, solvent quality, temperature, and chain stiffness dependence of solution viscosity. Accurate expressions for molar mass and solvent quality dependence of the scaling concentration factor were established, first for moderate concentrations, but for several systems (where the data were available) they were found valid beyond the entangle-

ment region. These activities began collaboration that lasted 47 years.

At USC Simha started a major effort on the thermodynamic properties of polymer melt and glasses. With Ray Boyer he investigated correlations between glass transition temperature, T_g, and change in thermal expansivity at T_g. This started studies of sub-T_g relaxations, down to liquid nitrogen temperatures carried out by Bob Haldon. The work with Vidya Nanda on cell theory led to the famous cell-hole model developed with Thomas Somcynsky.

In 1968 Robert accepted an invitation to Case Western Reserve's University, where his research interests continued to focus on the condensed polymeric state. His student, Anh Quach, constructed a pressure dilatometer for the determination of the pressure-volume-temperature (PVT) dependencies of two polymers and compared these data with theory – for the first time the quantitative agreement with theory was observed. This work set the pattern for further studies of at least fifty polymers. There was international collaboration, e.g., with Raj Jain for extending the hole-cell theory to multicomponent systems, with Eric Nies and Alexander Stroeks to the phase equilibria, with Hankun Xie to the gas solubility, subsequently used for the interpretation of foaming data by Chul B. Park. Another studies examined semi-theoretical interrelations between the computed hole fraction and non-equilibrium phenomena. Thus, with John Mckinney Simha has shown that glass formation involved a partial freeze-in of free volume at T_g. Then there was initiated by Utracki study of correlation between the hole fraction and viscous flow. The hole-cell theory has been used for interpretation of the positronium annihilation data with John McGervey, Alex Jamieson, Gianni Consolati and Franz Maurer. A further extension consisted of a theory of elastic constants of polymer glasses by Elisabeth Papazoglou. Finally, there was the dynamics of volume relaxation during physical aging. With John Curro and later with Richard Robertson this was treated as a dynamics of free volume states.

To the very end Robert remained an active and brilliant scientist, dedicated to the theoretical physics with child-like fascination for the practical consequences of the derived equations. His work has had large impact on the science and engineering of polymers and plastics. It also provided a direct demonstration of the importance of fundamental research to the evolution of technology and the global economy. To the very end Simha remained a most cherished member of the polymer physics community, enlivening scientific discussions and social events with his wry but gentle sense of humor. With his extraordinary memory, to the very end he remained a valuable resource to students and colleagues, often pulling out decades old reprints discussing solution of a supposedly new research problem. He was a warm human being, loving husband of Genevieve, enthusiast of classical music, of the world and its science history, as well as devotee of nature. We shall miss him dearly.

L. A. Utracki, I. Otterness, A. M. Jamieson

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