Special issue dedicated to the 90th birthday of Robert N. Haward

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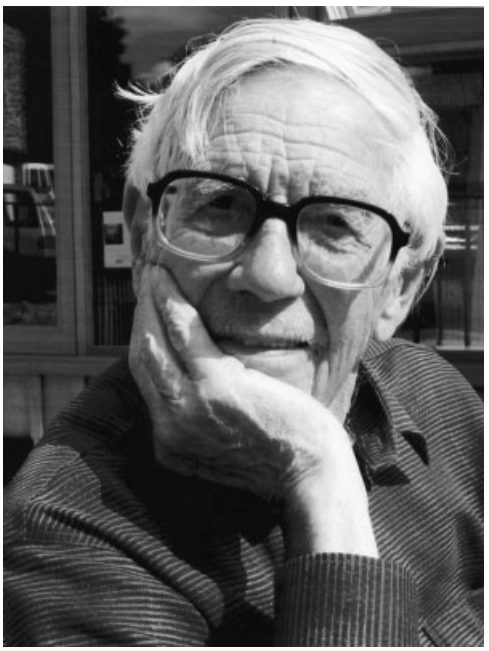
Robert Nobbs Haward is truly a remarkable man. He will celebrate his 90th birthday on April 17th 2004, and despite this respectable age he is still actively pursuing his research on yield and fracture of polymer systems. Counting from his first publication in 1939, this also gives rise to another special occasion, his 65th year as an actively publishing scientist. Although he is probably best known for his work in polymer physics, specifically for his contribution to the insight in post-yield and fracture phenomena in polymers, his achievements in the field of polymer chemistry are likely impressive, with a mere 38 patents on polymer synthesis.

The unusual combination of synthesis, physics and mechanics make Bob Haward one of the true pioneers in the field of structure-property relations in thermoplastics. In this respect it is illustrative to have a glance at some details of his impressive career, visualized in Figure 1 where the cumulative development of his patents, as well as that of his publications in the field of polymer physics and synthesis are plotted.[1]

It all starts with a PhD at Cambridge around 1938. During the war he worked on the development of bulletproof laminated glass at Colmore Adhesives Ltd. in Gateshead-on-Tyne. It is here where his interest in mechanical properties of plastics and glass arises, and throughout the forties he is actively publishing in this field, eventually leading to the publication of his monograph "The Strength of Plastics and Glass" in 1949. In the late forties he joins Petrocarbon Ltd. (later Shell) near Manchester, where he researched and started the first British-owned polystyrene plant. Throughout the fifties and early sixties he concentrates his research on polymer chemistry. A turnover takes place in the early sixties when he is offered a part-time position as a reader on the university of Manchester (UMIST). As visualized in Figure 1, this clearly initiates a revival of his interest for mechanical and physical properties of polymers. A landmark in the following period is his collaboration with G. Thackray on the "Use of a mathematical model to describe isothermal stress-strain curves in glassy thermoplastics".[2] In this work it was recognized for the first time that the post-yield behavior of polymer glasses could be decomposed in a viscous contribution of a stress-activated flow process and an (rubber)elastic contribution of the entanglement network. This proved to be an important basis for the development of 3D-viscoplastic constitutive relations that took off in the early nineties.



Bob Haward: A chemist on the quest for strength

Bob continued working for Shell until he was appointed full professor at the University of Birmingham around 1971. In the following period he edited a number of books: "The Physics of Glassy Polymers" and the series "Developments in Polymerization". He studied in detail fracture phenomena in polymers, and explored their relation to post-yield phenomena and structural parameters. Having the advantage of being a chemist, he was able to translate his insight in the molecular phenomena in the development of new polymers with improved properties, that is, improved

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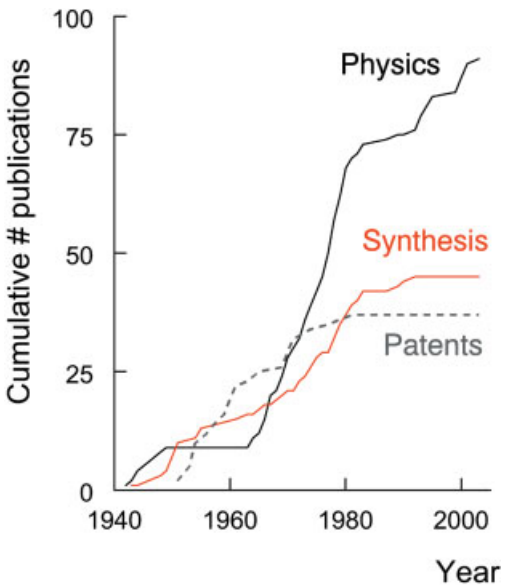

Figure 1. Development of the cumulative number of Bob Haward's publications over the years.

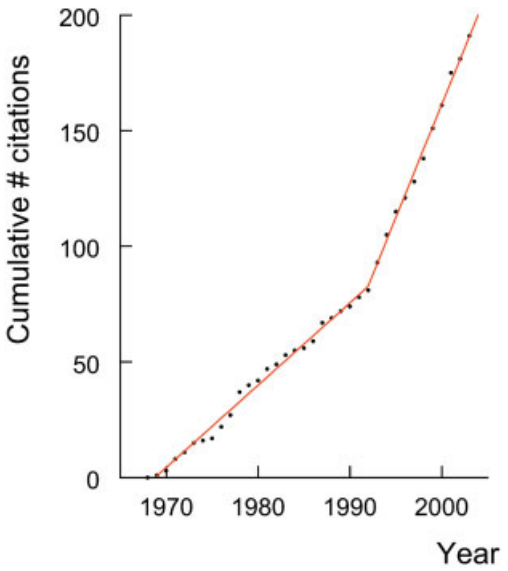

Figure 2. Development of the cumulative number of citations to the "Haward-Thackray" paper.

strain hardening leading to a low tendency to develop plastic instabilities. After his retirement in 1981 he returned to Manchester and became a visiting professor at UMIST. Deprived of his own personal laboratory, he initiated collaborations with several scientists throughout the UK and the European main land. In 1997 he edited the second edition of "The Physics of Glassy Polymers" this time co-edited by Bob Young.

The continuing importance of Bob's pioneering work on the post-yield behavior of glassy polymers is witnessed by the cumulative development of the number of citations to the "Haward-Thackray" paper over the years,[3] visualized in Figure 2. Polymer physicists will instantly recognize the remarkable resemblance of the shape of the curve with that the development of viscosity as a function of molecular weight. Following this analogy, it appears that around 1993 the "citation density" reaches a critical value as the annual number of citations increases by a factor of 3. It appears that a new generation of scientists has picked up his message.

The contributions to this special issue come from colleagues who have benefited in various ways from their involvement with Bob. All are offered in appreciation for his outstanding and continuing contribution to Polymer Science.

L.E. Govaert
Section Materials Technology (MaTe)
Eindhoven University of Technology
P.O. Box 513
NL-5600 MB Eindhoven, The Netherlands

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