Plenary

The Mechanical Performance of Polymers and Polymer Composites at High Strain-Rates

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Polymer-based systems in general have non-linear mechanical properties which are highly-temperature dependent and strain-rate sensitive. They are widely used in applications where factors such as weight, strength and energy-absorbing properties need to be balanced. In this presentation intermediate to high-rate characterisation techniques are described [1].

The importance of predictive modelling, using a limited empirically measurable parameter set emphasised, especially those models which start from molecular considerations. This approach will be illustrated by comparison of the high-rate studies with predicted constitutive equations.

A number of material classes e.g. polymers (polythene, polycarbonate), mono-polymer composites (DYNEEMA), polymer-bonded composites (in particular polymer-bonded explosives and the corresponding inert stimulants [3,4]) will illustrate the range of behaviour encountered.

Overall, a consistent approach to molecular structure, strain-rate, temperature, and bulk material properties is emphasised.

[1] Field JE, Walley SM, Proud, WG, Goldrein, HT, and Siviour, CR,. IJIE, 30 (2004),, 725-775.

[2] D. Porter, P.J. Gould, IJSS 46 (2009) 1981–1993

[3] S.M. Walley, J.E. Field, P.W. Blair, A.J. Milford, IJIE 30 (2004) 31–53

[4] P R Laity., C. R. Siviour.. Shock Compression of Condensed Matter - 2005. M. D. Furnish, M. Elert, T. P. Russell and C. T. White. Melville, NY, American Institute of Physics: 905-908. (2006)

Dr. William G. Proud Trained as a Chemist, Degree BSc (hons.) 1st University of Newcastle upon Tyne (1987), PhD in Physical Chemistry (1990) from the same institution. Spent 1990-1992 as a post-doctoral researcher at the University of Barcelona, Spain. During the summer of 1993 spent three months as a visiting lecturer at the State University of Sao Paulo, Brazil in the field of electrochemistry.

Started research in the Cavendish Laboratory, Cambridge January 1994 concentrating on propellant combustion. His research interest expanded to include Shock Physics and a wider area of material response to stress, including materials such a polymer s and polymer composite systems. Research Fellow of Clare Hall College 1997-2000. In September 2003 was appointed head of Fracture and Shock Physics Group at the Cavendish Laboratory which and receives funded by QinetiQ, EPSRC, AWE and de Beers amongst others. In October 2009 was appointed Reader in Shock Physics at Imperial College London. Currently engaged in building the research profile of this institute.