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Towards a Predictive Model of Elastomer seals MUSAB KHAWAJA, Imperial College London, Department of Physics, London SW7 2AZ, UK, ARASH MOSTOFI, Imperial College London, Departments of Materials and Physics, London SW7 2AZ and the Thomas Young Centre for Theory and Simulation of Materials, UK, ADRIAN SUTTON, Imperial College London, Department of Physics, London SW7 2AZ, UK, JOHN STEVENS, Baker Hughes, Materials Centre of Excellence, Houston, Texas 77019-2118, USA — Elastomers are a highly versatile class of material. Their diversity of technological application is enabled by the fact that their properties may be tuned through manipulation of their constituent building blocks at multiple length-scales. These scales range from the chemical groups within individual monomers, to the overall morphology on the mesoscale, as well as through compounding with other materials. An important use of elastomers is in seals for mechanical components. Ideally, such seals should act as impermeable barriers to gases and liquids, preventing contamination and damage to equipment. Elastomer failure, therefore, can be extremely costly and is a matter of great importance to industry. The question at the centre of this work relates to the failure of elastomer seals via explosive decompression. This mechanism is a result of permeation of gas molecules through the seals at high pressures, and their subsequent rapid egress upon removal of the elevated pressures. The goal is to develop a model to better understand and predict the structure, porosity and transport of molecular species through elastomer seals, with a view to elucidating general design principles that will inform the development of higher performance materials.

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