Using mechanofluorescence as a tool to investigate fracture of interpenetrated

networks

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The demand for soft but tough materials is increasing in many new applications such as large amplitude actuators, flexible electronics or prostheses. The range of use is limited by the propagation of a crack. Therefore, initiation and propagation of a crack, and more precisely dissipative mechanisms at the crack tip are crucial phenomena to investigate. A promising way to understand soft material failure is to adopt a multi-scale approach linking bond scissions at a molecular scale to macroscopic fracture of the sample.

We prepare interpenetrated multiple network elastomers as model soft and tough materials to bring in a controlled fraction of breakable bonds. We introduce a mechanically activable molecule, developed by R. P. Sijbesma group [1], into polymer network architectures. This molecule, so-called 9π-extended anthracene Diels Alder adduct, can provide post-mortem bond scission mapping based on the fluorescence activation upon bond breakage. Microscopic observations enable a convenient detection and precise mapping of post-mortem bond scission during a mechanical test.

1. *Göstl R.; Sijbesma R. P., Chem. Sci., 2016, **7**, 370-375*

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