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Activation-deactivation of self-healing in supramolecular rubbers LAURENT CORTE, FLORINE MAES, DAMIEN MONTARNAL, SABINE CANTOURNET, FRANCOIS TOURNILHAC, LUDWIK LEIBLER, MINES-PARISTECH CNRS (UMR7633) TEAM, ESPCI-PARISTECH CNRS (UMR7167) TEAM — Self-healing materials have the ability to restore autonomously their structural integrity after damage. Such a remarkable property was obtained recently in supramolecular rubbers formed by a network of small molecules associated via hydrogen bonds [1]. Here we explore this self-healing through an original tack experiment where two parts of supramolecular rubber are brought into contact and then separated. These experiments reveal that a strong self-healing ability is activated by damage even though the surfaces of a molded part are weakly self-adhesive. In our testing conditions, a five minute contact between crack faces is sufficient to recover most mechanical properties of the bulk while days are required to obtain such adhesion levels with melt-pressed surfaces. We show that the deactivation of this self-healing ability seems unexpectedly slow as compared to the predicted dynamics of supramolecular networks. Fracture faces stored apart at room temperature still self-heal after days but are fully deactivated within hours by annealing. Combining these results with microstructural observations gives us a deeper insight into the mechanisms involved in this self-healing process. [1] P. Cordier, F. Tournilhac, C. Soulie-Ziakovic & L. Leibler, Nature, 451, 2008.

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