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Mimic of collagens properties by creating sacrificial bonds on synthetic polymer

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Sacrificial bonds and hidden length confer on hard and dry natural materials, high strength, stiffness, toughness, and self-recovery of its function in response to successive mechanical stimulation at the molecular scale. This type of links is involved in complex hierarchical structures, such as bone, tendons, ligament, nacre, mussels… These natural materials have high toughness. It has excellent mechanical properties as well as remarkable self-regenerative properties, like self-healing behavior 1,2, which arises in part from secondary sacrificial bonds between chain segments in coiled organic phase.

In the last ten years there have been many important advances in the development of self healing polymers 3-11 and polymer Nanocomposites. Biomimetics12-16 aims to reproduce some of the properties of natural structural materials, using rationally engineered and scalable components and processes.

The understanding of the functioning and the principle of the forming mechanism of sacrificial bond (Sb) is of significant fundamental interest. Indeed, this phenomenon governing interactions at the molecular level of different natural materials (bones, skin, tendons, abalone, toils of Spider, pearl ....) Is not yet fully elucidated well.

In this work we looking for mimic of the collagen fiber with creating Sb on individuals poly(Acid-Acrylic) (PAA) chains. We present the results of dynamic force spectroscopy experiments conducted on individuals PAA chains, which were Immersed in a physiological buffer. Through these experiences, the hidden length and the strength of the rupture of Sbs Were Measured, in function of loading rates. A clear scheme of formation of Sbs was revealed, and The energy released by their rupture was quantified.

These results made it possible to understand the role played by these bonds in the mechanical properties at the molecular level.

Biography

Sadia Radji is an Associate Professor in Department of Physics at the University of Pau and the Adour / IPREM-EPCP countries. Before joining University of Pau and the Adour, she worked as Contract of temporary teaching and research assistant (ATER), in Department of Physics, at University of Nantes. From October 2006-November 2009 she did her PhD thesis in Physics of Materials. Jean Rouxel Materials Institute (IMN). Her research interests include Structural properties of materials at nanoscale and molecular scales.

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