

Abstract Submitted
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X-ray scattering to probe cracks in rubbers¹ COSTANTINO CRETON, QUENTIN DEMASSIEUX, ESPCI Paris, DANIEL BERGHEZAN, Michelin — Natural rubber is a well-known very tough elastomer and its toughness is generally attributed to its aptitude to crystallize under strain. Yet the mechanism linking the extent of strain induced crystallization to the toughness gamma is still unclear. We mapped by scanning microbeam X-ray diffraction (20 microns resolution), the straininduced crystallization near the crack tip of highly crosslinked and carbon-black filled natural rubbers. Experiments were carried out on static cracks loaded at different values of energy release rates G and for different filler and crosslinker concentrations. We specifically investigated the effect of the crosslinking density, the effect of thermal (oxygen-free) aging and the effect of temperature (between 23 and 100 C). Several novel findings are reported : a significant amount of crystallization was still present at the crack tip at 100C, thermal aging (in the absence of oxygen) greatly reduces the amount of crystallization at the crack tip without much effect on the room temperature resistance to fatigue crack propagation of the material, and an increase in crosslinking density reduces the extent of crystallinity at the crack tip for the same applied G .

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