A novel elastomer/liquid crystal polymer nanocomposite created *in situ* from controlled radical graft-polymerization†

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Received 7th August 2007, Accepted 1st October 2007
First published as an Advance Article on the web 16th October 2007
DOI: 10.1039/b711928c

We present the original design and properties of a novel, *all-polymer* hierarchical composite comprising an elastomer and a fluorinated liquid crystal polymer. The material follows from the phase separation between the two highly incompatible components, occuring *in situ* during the controlled radical graft-polymerization of the liquid crystal monomer onto functionalized elastomeric chains. We demonstrate that the composite remarkably combines the mechanical properties, static and dynamic, of both an elastomer and a semi-crystalline polymer. We thereby illustrate how the careful choice of a graft can provide a simple rubbery material with original and antonymic functionalities. Here, the temperature-sensitive liquid crystal polymeric domains act as hard particulate fillers under their fusion temperature and liquid softening inclusions above, with fast reversible transitions from one state to another. A variety of composites combining physico-chemical features difficult to marry otherwise may be designed following this simple method.