

Under pressure to react – acetylenedicarboxylic acid polymerisation

Iain Douglas Hood Oswald¹, Ian Hutchison¹, Amit Delori¹, Andrew Urquhart²

¹University Of Strathclyde, Glasgow, United Kingdom, ²Technical University of Denmark, Department of Micro- and Nanotechnology, Ørsteds Plads, Building 345Ø, 2800 Kgs., Lyngby, Denmark
E-mail: iain.oswald@strath.ac.uk

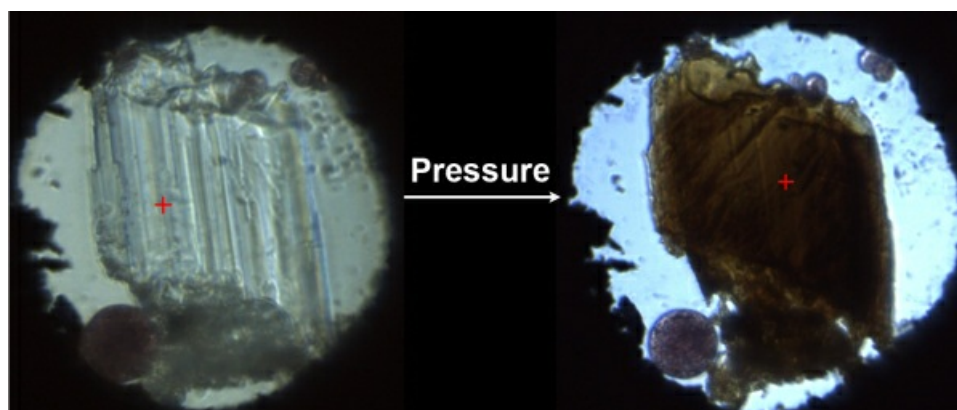
Organic polymers play an important role in our life and we use many such polymers on day to day basis such as polyethene, nylon, kevlar, PVC, bakelite, teflon etc. Solid state synthesis of polymers is of great interest, as the polymers synthesized by this route might have different properties as compared to those obtained via solution methods. This is possible due to the rigid position of the molecules with respect to each other; their orientation being a crucial component in the formation of the polymer backbones. Hence polymorphism in monomeric systems can play a significant role in the outcome of the polymerization. Such solid state syntheses of acetylene derivatives is of special interest as it may selectively form conducting polyacetylene polymers, which are much needed for applications such as solar cells and as organic light emitting diodes, which in turn are required in the manufacturing of displays for TV, mobile phones, cameras etc. Pressure is a powerful thermodynamic variable that can induce polymorphism as well as polymerization. Example of these reactions are ethylene,[1] butadiene,[2] and acrylic acid.[3]

In this talk we will describe the polymerisation of acetylenedicarboxylic acid (ADCA) via the application of pressure. Traditional solid state polymerization of ADCA is marked by very low yields (around 5.5%) and long exposure times of γ -radiation (>10 days) whilst we will show that the chemical reaction can occur in a fraction of the time by applying pressure. Structural data has been collected on the system up to the reaction point using X-ray diffraction methods and shown that ADCA undergoes two polymorphic transitions before the reaction. Pixel calculations have been performed to provide information on intermolecular interactions as a function of pressure. Raman spectroscopy has been used to help identify the intramolecular changes over the chemical reaction.

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