Rheology of cellulose/1,5-diazabicyclo[4.3.0]non-5-enium propionate solutions and shaping into aerogel beads

Lucile Druel[1], Philipp Niemeyer[2], Barbara Milow[2], Tatiana Budtova[1]

[1] *MINES ParisTech, PSL Research University, Centre for Material Forming (CEMEF), UMR CNRS 7635, CS 10207, 06904 Sophia Antipolis, France*

[2] *Deutsches Zentrum für Luft- und Raumfahrt Institut für Werkstoff-Forschung, Abteilung Aerogele, Linder Höhe, 51147 Köln, Germany*

Aerogels are materials with fascinating properties: they are highly porous, with very low density (around 0.01 – 0.2 g/cm^3) and nanostructured with high specific surface area. Cellulose based aerogels are new and very promising materials offering a wide range of potential applications from bio-medical and cosmetics (delivery systems, scaffolds) to materials for adsorption and/or separation and electro-chemistry when pyrolysed.

Cellulose aerogel beads were made with the JetCutting technology and dried by supercritical CO_2 extraction. Ionic liquid, 1,5-diazabicyclo[4.3.0]non-5-enium propionate ([DBNH][CO_2Et]), was shown to be a suitable solvent due to its rheological and thermodynamic properties. The flow and viscoelastic properties of cellulose-[DBNH][CO_2Et] solutions were studied in detail as a function of polymer concentration and solution temperature. Beads were prepared from 2 and 3 wt% cellulose-[DBNH][CO_2Et] solutions and coagulated in water, ethanol and isopropanol. Bead sizes ranged from 0.5 to 0.7 mm when made from 2 % solutions and up to 1.7 mm when prepared from 3 % solution. Cellulose aerogel beads prepared by the JetCutting possessed specific surface area of 240 – 340 m^2.g^{-1} at densities of 0.04–0.07 g.cm^{-3}.

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