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PRESS RELEASE
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3D printed conductive cellulosic structures

September 29, 2017, Ying Shao defended her doctoral thesis at University Grenoble Alpes prepared under the supervision of Davide Beneventi, CNRS Research Director, of Professor Didier Chaussy (Grenoble INP-Pagora / LGP2) and of Philippe Grosseau, Research Director (École des Mines, Saint-Étienne). She presented the results of her research work entitled *Use of lignocellulosic materials and 3D printing for the elaboration of conductive carbon strutures*.

In this thesis, electrically conductive and mechanically resistant carbon structures were elaborated by 3D printing and subsequent pyrolysis using microfibrillated cellulose, lignosulfonate and cellulose powder (MFC/LS/CP) blends.
The processability of MFC/LS/CP slurries by 3D printing was examined by rheological tests in both steady flow and thixotropic modes. The printed MFC/LS/CP pastes were selfstanding, provided a high printing definition and were proved to be morphologically stable to air drying and the subsequent pyrolysis.

Pyrolysis at a slow rate (0.2°C/min) to a final temperature in the range of 400-1200°C was used to manufacture MFC/LS/CP carbons. The TGA/DTG was applied to monitor the thermal degradation of MFC/LS/CP materials in blends as well as in a separated form. The resulting carbons were further characterized in terms of morphology, microstructure and physical properties (such as density, electrical conductivity and mechanical strength). At 900°C, MFC/LS/CP carbons displayed a high electrical conductivity of 47.8 S/cm together with a low density of 0.74 g/cm3 as well as an important porosity of 0.58. They also achieved an elastic modulus maximum of 6.62 GPa. Such interesting electrical and mechanical properties would lead to a promising application of MFC/LS/CP- derived biocarbons in energy storage devices as electrode materials in close future.

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The Laboratory of Pulp and Paper Science and Graphic Arts (LGP2) is a joint research unit (UMR 5518) run by the CNRS, Grenoble INP and the Agefpi. It is home to three teams: Biorefinery: chemistry and eco-processes – Multiscale biobased materials – Surface functionalization through printing processes. The research conducted by LGP2 strives to meet society's expectations when it comes to sustainable development (green chemistry, clean processes, recycling, biobased materials, renewable energy) and traceability & safety (functional materials, smart paper and packaging). ***http://pagora.grenoble-inp.fr/research/***

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