ABSTRACT:

Vat 3D Printing of Ionically Conductive Polymers for Tactile Sensors

M.V. Piras1, G. Mogli 2, F. Secci 1, I. Roppolo2, S. Stassi2, A. Chiappone1
1Department of Chemical Science and Geology, University of Cagliari, Cagliari, Italy
2Department of Applied Science and Technology, Politecnico di Torino, Torino, Italy

Smart sensors based on conductive soft polymers have shown remarkable potential whenever a link between the “soft” human world needs an interface with the “rigid” electronic one is required, in fields like wearables and soft robotics. [1] However, conventional manufacturing technologies, such as casting processes, limit the obtainable shapes and applications. 3D printing offers a valid alternative for producing customizable and conformable sensors and, among the printing technologies, light-induced ones allow high printing precision and fast production. Nevertheless, developing highly deformable and conductive thermoset photocurable polymers is not trivial; merging these requirements with those linked to the 3D printability of the formulation makes the target challenging. [2] Herein different materials that were successfully tailored to obtain 3D printable tactile sensors will be presented. On one side photocurable ionic conductive hydrogels have been synthesized and 3D printed in different complex shapes to enhance the sensing properties. This material possessed exceptional mechanical behaviour, sensitivity and, furthermore, showed the capacity for self-repair. [3] Alternatively, a mixture based on acrylic acid and hydrated salt was used to homogeneously disperse and simultaneously functionalize cellulose pulp extracted from local waste. In this way, 3D printable formulations were obtained and the precise printing of highly stretchable and sensitive structures presenting stable response at different temperatures was achieved. Beside these, different materials based on innovative crosslinkers are currently under investigation.

[1] C.Yang, Z. Suo, Z. Nature Reviews Materials 3, 125-142 (2020)
[2] Y.Tang, B. Dai, B. Su, Y. Shi, Frontiers in Materials 8, (2021)
[3] G. Mogli, M. Reina, A. Chiappone, A. Lamberti, C. F. Pirri, I. Roppolo, S. Stassi Adv Funct. Mater. 2024, 34, 2307133