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### **The relation between the alpha/beta relaxation dynamics and the shape of ionomer building blocks**

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The relation between the alpha/beta relaxations and the shape of the building blocks of ionomer materials is a key factor for programming an important temperature-dependent property: the memory of shape [1,2,3]. However, the morphology of ionomers is indirectly obtained via modeling of small angle X-ray scattering (SAXS) data owing to the hardly accessible image characterization of the nanometric building blocks - micelle-like cylindrical polymeric aggregates (radius ~ 2 - 6 nm and length > 100 nm) [3]. Herein, broadband dielectric spectroscopy (BDS) measurements, free from electrode polarization effects, allowed identifying the time and temperature dependence of the polarization of different length scales of the ionomer matrix, and more importantly, by directly providing the aspect ratio of the radius and length of the polymeric aggregates for each desired temperature. This finding is essential for controlling the shape of ionomer based functional products under several stimuli conditions, thereby advancing remarkable applications, such as four dimensional (4D) printing and polymer electrolyte fuel cells. \\ Acknowledgements \\ We thank the Brazilian funding agencies (CAPES, CNPQ, FAPESP 2013/50151-5, 2014/09087-4, 2014/50279-4 and 2016/14785-8), LNLS (18801 and 20160239) and CNEN. \\ References [1] S. Tibbits, 4D Printing: Multi-Material Shape Change. *Architec. Design.* 84 (2014) 116–121. [2] Q. Ge, H. J. Qi, M. L. Dunn. Active materials by four-dimension printing. *Appl. Phys. Lett.* 103 (2013) 131901. [3] T. Xie, Tunable polymer multi-shape memory effect, *Nature* 464 ( 2010) 267-270.