Macroscopic tensile piezoelectricity characterization of β-chitin in tubeworm tissues

Matthieu Fumagalli*[1]

[1]Ingénierie des matériaux polymères – Ingénierie des Matériaux Polymères - UMR 5223 - Site Lyon1 – France

Résumé

Natural polysaccharide crystals, such as cellulose and chitin microfibrils, are considered piezoelectric thanks to the low symmetry of their crystal structures. However, the polycrystalline nature of macroscopic samples hinders the investigation of the piezoelectric properties of these crystals. β-chitin microfibrils have a single crystal-like three-dimensional orientation in the housing tube of tubeworm *Lamellibrachia satsuma* where all the molecular chains possess the same chain polarity. Here, we exploited this unique tissue architecture for piezoelectric characterization at the macroscopic scale. Based on direct piezoelectric measurements with varying loading direction, amplitude, and frequency, we obtained a piezoelectric coefficient close to 1 pC/N unambiguously related to the tensile coefficient of the β-chitin crystal. This study proves for the first time the significant tensile piezoelectricity of materials made of crystalline polysaccharides and ultimately contributes to the development of piezoelectric materials based on abundant polysaccharides.

*Intervenant