Supplemental Data: Quantitative characterization of piezoelectric property in biological system via piezoresponse force microscopy (#1808)

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Figure 1 a) shows the piezoresponse of a single type I collagen fibril depending on the substrate types, conductive (gold) and non-conductive (glass). Totally, ten collagen fibrils were measured, and 110 data points of each fibril was obtained depending on input voltage (n=1100). In lateral direction, the piezoelectric coefficient of the collagen on conductive and non-conductive substrate were obtained as 0.56 pm/V and 0.14 pm/V, respectively. Figure 1 b) and c) show the PFM maps combining structural and piezoresponse information, in which the structure of the map represents topography information the collagen fibril while color map represents its piezoresponse amplitude showing heterogeneous nature of collagen piezoelectricity. In addition, the effect of electrostatic force on piezoresponse result was investigated depending on the measurement direction and substrates as seen in figure 2. For the results in the vertical direction, the electrostatic force was compensated at a certain DC voltage offset (e.g., 500 mV on gold and 800 mV on glass), while the electrostatic force does not alter the PFM amplitude in the lateral direction.

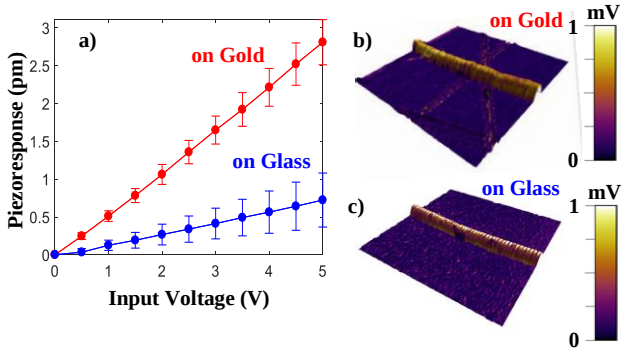

Fig.1 a) Piezoresponse of a Type I collagen fibril in the lateral direction on gold and glass substrates. b-c) PFM maps combining piezoresponse and topography of type I collagen on gold coated and glass substrates.

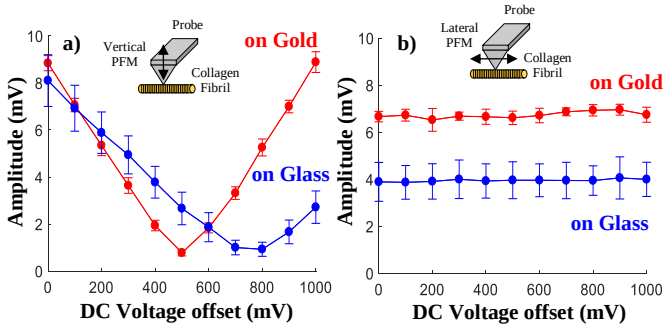

Fig.2 Electrostatic force contribution to piezoresponse amplitudes of a type I collagen depending on DC voltage offsets in the vertical, a) and lateral directions, b).