Triboelectricity in Insulators: Further Evidence for a Mechanochemical Mechanism

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***Abstract*—Recent results show that mechanochemical reactions triggered by friction produce ionic polymer chain fragments that are transferred between surfaces of the rubbed bodies, even when these are pieces of the same polymer. This work presents new evidence in support of this statement, based on electrostatic potential mapping techniques coupled to analytical scanning electron microscopy. The previously described formation of fractal charge patterns is the result of polymer fragment scatter on both rubbed surfaces. Fractal dimension was calculated for the flat area of a HDPE stub after rubbing PTFE slab and using SEI and BEI micrographs, yielding D = 1.55 ± 0.01 for SEI and 1.85 ± 0.02 for BEI image contrast patterns. This result shows that chemical composition spatial variations follow a more complex pattern than the surface topography. The complexity of the distribution of chemical composition is also larger than typical fractal dimension for electric charge patterns (1.64-1.72), which is explained considering the occurrence of microdischarge as a smoothing factor for potential gradients. Beside s, microanalytical EDX detection of nitrogen on HDPE surface is an evidence for atmospheric gas participation including tribo-plasma high-energy species reacting with the polymer surface. The present results verify the mechanochemical mechanism for polymer tribocharging and wear, contributing to a better understanding of the difficulties for establishing and interpreting the triboelectric series.**