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# (G*) (POS-12) The Piezoelectric Contribution in the Catalytic Activities of BaTiO3 Nanoparticles

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It is an increasingly urgent to protect the environment from the different kinds of pollutants, in particular industrial pollutants. Wastewater treatment is one example of these efforts that are necessary for mankind to enjoy a sustainable future. Recently, the use of piezoelectric nanomaterials as catalyst for water purification has been reported. It has been demonstrated that the piezoelectric properties of nanomaterials in solution, can be used for the degradation of organic pollutants, when activated by ultrasonic waves. When submitted to ultrasonic waves, however, other physical phenomena also contribute to the degradation of organic pollutants: Tribocatalytic activity comes from the frictions of the particles generating of transient charges that cause the degradation of organic compounds. Moreover, at higher ultrasonic energies, cavitation bubbles can occur, whose collapse creates localized pockets of high temperature in excess of 4000K and high pressure in excess of 1000 atm decomposing organic pollutants, a phenomenon called sonolysis. A general literature review shows not enough attention has been devoted so far to discriminate between these various effects, in particular when studying the pollutant degradation, using piezocatalyst materials such as BaTiO3 nanoparticles. In this study, we quantified the piezo-, tribo- and/or sonocatalytic activities of BaTiO3 nanoparticles, comparing their catalytic activities to that of non-piezoelectric TiO2 nanoparticles, which happen to have a similar surface termination. This comparison allows us to derive the contribution of the piezoelectric effect in the catalytic degradation reactions. BaTiO3 and TiO2 crystalline nanoparticles were characterized using X-ray diffraction and Raman spectroscopy. The degradation of methyl orange in water has then been measured using either BaTiO3 or TiO2 as catalysts. Comparing the results for BaTiO3 and TiO2 allows us to experimentally quantify the portion of the piezoelectric effect in the catalytic activity of BaTiO3 nanoparticles.

**Authors:** KALHORI, Hossein; Dr HADJ YOUSSEF, Azza (INRS-EMT); RUEDIGER, Andreas (INRS-EMT); Prof. PIGNOLET, Alain (INRS-EMT)

**Presenter:** KALHORI, Hossein

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