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Fe_2O_3 nanoparticles for airborne organophosphate detection[1]
JOSHUA PHILLIPS, University of Alabama, JENNIFER SOLIZ, US Army Edgewood Chemical Biological Center, ADAM HAUSER, University of Alabama — Dire need for early detection of organophosphates (OP) exists in both civilian (pesticide/herbicide buildup) and military (G/V nerve agents) spheres. Nanoparticle materials are excellent candidates for the detection and/or decontamination of hazardous materials, owing to their large surface to volume ratios and tailored surface functionality. Within this category, metal oxides include structures that are stable with the range of normal environmental conditions (temperature, humidity), but have strong, specific reaction mechanisms (hydrolysis, oxidation, catalysis, stoichiometric reaction) with toxic compounds. In this talk, we will present on the suitability of Fe_2O_3 nanoparticles as airborne organophosphate detectors. 23 nm particles were exposed to a series of organophosphate compounds (dimethyl methylphosphonate, dimethyl chlorophosphonate, diisopropyl methylphosphonate), and studied by x-ray magnetic circular dichroism and x-ray absorption spectroscopy to confirm the stoichiometric Fe_2O_3 to FeO mechanism and determine magnetic sensor feasibility. AC Impedance Spectroscopy shows both high sensitivity and selectivity via frequency dependence in both impedance and resistivity, suggesting some feasibility for impedimetric devices.

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