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Sensors on paper related products based on self-assembled silica nanostructures

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Abstract

Alabama Center for Paper and Bioresource Engineering has developed a technology that enables diatomites to be used as nanostructured sensor element on the surface of paper and paper related products. The diatomites we use are silica based inorganic material with high surface area and are very low in cost (< $1 per lb). The first application we have developed has been in smart food packaging and is using a novel gas sensor with pH sensitive dies immobilized into the diatomites. In this application the nanosensor elements were applied on paper using a polymer binder. The detection mechanism is based on a distinct color change in the presence of total volatile basic nitrogen (TVB-N) emitted in the process of meat and fish spoilage. In our preliminary tests these nanosensors give conclusive correlation between bacteria growth, "sell by" dates, and nanosensor coloration. This technology is considered as a platform technology and several other applications are currently being investigated. One of the most recent applications our research team is looking at is neurotoxin sensor paper that has a detection mechanism based on appearance of distinct color changes on the nanosensor when neurotoxins are not present. We will continue to advance our research also by looking at using ink-jet techniques in scaling up of this technology and by using nano-fibrillated cellulose as a potential binding agent for the sensors.

Biography

Dr. Marko Hakovirta has a PhD in Physics from the University of Helsinki, Finland and MBA from Er University, USA. He has worked as a directors funded postdoctoral fellow at Los Alamos National Laboratory and fellow at CERN. He was also a Research Fellow of the Academy of Finland. He has served as a reviewer for several reviewed journals. Dr. Hakovirta has also an extensive industrial background having worked in industry for about 10 y in different leadership positions in corporate strategy, R&D and environmental management. Before joining Au University he worked as an Associate Director for IPST at Georgia Tech. He is currently director of Alabama Cente Paper and Bioresource Engineering and Professor in the Department of Chemical Engineering at Auburn University.