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Ecosystem of innovations in nanotechnology based platforms in support of safety, security & sustainability

Ashok Vaseashta

Institute for Convergence of Information, Science, Technology, and Knowledge, and International Clean Water Institute, USA

Abstract

Advances in nanomaterials, coupled with information technology, cognitive sciences, biotechnology, artificial intelligence and genetics offer novel, unique and potential solution pathways in ways heretofore unimagined. This presentation offers several recent paradigm-shift in concepts such as deployment of systems with enhanced situational awareness capabilities to tag, track, and thwart threat at point-of-origin (PO2), contaminants detection and remediation, force protection, seamless integration of wearable electronics and sensor networks, to name a few.Additional capabilities include sensors/detectorsemploying materials, phenomena, and effects including multilayer semiconductor structures, specially formulated interfaces, and exploiting different regions of the electro-magnetic spectrum to provide various functionalities. Mechanisms such as plasmonics, refractive and nonlinear effects, absorption of electromagnetic radiation, fluorescence, and avalanche phenomena for the detection of small fluxes, remote detection of explosives by THz and neutron radiation, etc., provide additional sensing capabilities, in conjunction with algorithms for complex processing of information, providing end-to-end strategic assessments and modeling of mixed and complex hazardous environments to delineatethe signal from background interactions. Specific examples relating to radiation sensors based on polymeric materials, sensors for toxic industrial chemicals (TICs), and/or toxic industrial materials (TIMs), e-tongue to identify rapidly several waterborne microbial pathogens, and bio-mimetic materials will be presented. The overall scope encompasses abilities to sense and detect CBRNEagentsto provide accurate intelligence, surveillance, preparedness, force protection and interdiction of such combative postures from safety and security standpoint. Furthermore, the presentation illustrates how a nexus of technological innovations provide solution pathways in support of "smart" sustainability science and engineering, paradigm-shift in natural resources management, and applications from system-of-systems perspectives. As an example, concepts of water harvesting, effective filtration at point of use, and efficient waste water management systems will be discussed. Life-cycle assessment and quantitative risk assessment approaches to assess human health impact from a safety and sustainability standpoint will also be discussed.

Keywords: sensors, detectors, safety, security, sustainability, nanomaterials

Biography

Vaseashta received a Ph.D. from the Virginia Tech, VA in 1990. Currently, he serves as Director of Research at the CISTecK/ICWI with NUARI. Concurrently, he serves as visiting Professor in Romania and Chaired Professor at the Academy of Sciences of Moldova. He also served as a visiting scientist at the Weizmann Institute of Science, Israel. Since 2007, he had several fellowships at the U.S Department of State serving in the offices of WMDT and Foreign Consequence Management and as S&T advisor in the office of Verification and Transparency Technologies. He is fellow of the American Physical Society, Institute of Nanotechnology, and New York Academy of Sciences. He was awarded Gold medal by the University of Armenia for his contribution to Nanotechnology. He has earned several other fellowships/awards for his meritorious services. His research interests include counter-terrorism; chemical-bio sensors; water safety and security; environmental pollution monitoring and remediation; and green nanotechnology. He authored over 230 research publications and edited/authored six books. He is an active member of several national and international professional organizations.