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A review of light scattering by metallic nanostructures

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There is a considerable interest in developing nanoscale switching and sensing devices using metallic nanomaterial hetero structures. When light falls on the surface of the metal, surface plasmons couple with photons to create surface plasmon polaritons (SPPs). We will discuss theoretically and experimentally the SPPs in metallic nano-hole structures. We have investigated theoretically and experimentally the light-matter interaction in metallic nano-hole structures. The surface plasmon polaritons (SPPs) of this structure are calculated by using the transmission line theory and the Bloch theorem. Using the transfer matrix method we have found that the energies of SPPs are quantized and systems can have several SPPs depending on the radius and periodicity of the structures. A theory of the scattering cross section is developed usingthe Greens function method. A fairly good agreement between theory and experiments are found. It is found that energySPP peaks in the spectrum can be modified by changing the periodicity of the nano-hole structure.This can achieved by applying an external laser and external pressure pulse on the structure. The present findings suggested that these systems can be used as nanosensors and nanoswitches for medical and engineering applications.

Biography

Mahi R Singh received both MSc (1970) and PhD (1976) degrees from Banaras Hindu University, Varanasi in Condensed Matter Physics. After that he was awarded an Alexander von Humbold Fellow in Stuttgart University, Germany from 1979 to 1981. He also worked as Research Associate at University of North Carolina, Chapel Hill, USA. After that he joined the University of Western Ontario as Associate Professor in 1985. Currently he is Professor in this university. He also worked as a Chief Researcher at CRL HITACHI, Tokyo between November 1992 and May 1993. He was the director of the Centre of Chemical Physics at the University of Western Ontario, Canada. He has worked in many research are of science and technology including nanoscience, nanotechnology, nanophotonics, plasmonics, optoelectronics, photonic crystals, Metamaterials, semiconductor here structures, high temperature superconductors, positron annihilation, Josephson Junctions, many body theories, condensed matter physics, semiconductor devices, Thermal Transport, DNA Molecules and DNA wires and so on. He has published more than 250 papers in international journals. He has written several books which are used as text books at UWO, Canada. He has organized several international conferences. He has been invited as a plenary and an invited speaker in several international conferences throughout the world.

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Infrared 45° reflectometry: A new approach to characterize nanostructured epifilms and superlattices

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By exploiting a 45°-IR methodology we have performed comprehensive simulations of Δ45 spectra to justify its ability for directly identifying and measuring the long wavelength transverse optical (TO) and longitudinal optical (LO) phonons in MBE grown strained nanostructured polar ZnTe(CdTe), Cd1-xZnxTe epifilms and (CdTe)m/(ZnTe)n SLs overlaying GaAs (001) substrates. It is demonstrated that the oblique-incident far-infrared (OI-FIR) reflectivity and transmission spectra show insignificant changes to the resonance phonon frequency features of epifilms even if the film thickness is modified by hundreds of nanometers. For the nanostructured epitaxial samples grown on different substrates, we strongly believe that measuring Δ45 spectra is more pragmatic than the OI-FIR transmittance as it exhibits remarkable sensitivity to film thickness.

Biography

Devki N Talwar received his BS (1968), MS (1970) from Agra University and PhD (1976) from Allahabad University in India. From 1977-1980, he worked as a visiting scientist at the Commissariat à l'Energie Atomique (CEA), Saclay (France). He came to the US in 1980 and worked at the University of Houston from 1980-1982, and then at Texas A&M University from 1982-1987 as a visiting Assistant professor. In 1987 he joined the Physics faculty at Indiana University of Pennsylvania (IUP). During his tenure at IUP he has been awarded several grants from various research agencies including the National Science Foundation (NSF), Research Corporation, US Air Force, American Chemical Society, and National Research Council (NRC). He also received numerous academic awards including the University Professorship – the highest honor from IUP faculty and administration. In 1993, he organized an International Materials Research Society (MRS) Symposium during the Fall Meeting in Boston and edited all the research papers presented in the Symposium. Besides Teaching and Service responsibilities at IUP, his research has been directed toward investigating the role of defects in semiconductors, nanostructure materials, quantum wells and superlattices, for electronic and optoelectronic applications.

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