Abstract Submitted
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3D Epitaxy of Graphene nanostructures in the Matrix of Ag, Al and Cu[1] LOURDES SALAMANCA-RIBA, ROMAINE ISAACS, MANFRED WUTTIG, MELBURNE LEMIEUX, LIANGBING HU, JAIM IFTEKHAR, SERGEY RASHKEEV, MAIJA KUKLA, ODED RABIN, University of Maryland, AZZAM MANSOUR, Naval Surface Warfare Center — Graphene nanostructures in the form ribbons were embedded in the lattice of metals such as Ag, Cu, and Al in concentrations up to 36.4 at.%, 21.8 at% and 10.5 at.%, respectively. These materials are called covetics. Raman scattering from Ag and Al covetics indicate variations in the intensity of peaks at $\sim$ 1,300 cm^{-1} and 1,600 cm^{-1} with position on the sample. These peaks are associated with the D (defects) and G (graphite E_{2g} mode) peaks of graphitic carbon with *sp2* bonding and reveal various degrees of imperfections in the graphene layers. First principles calculations of the dynamic matrix of Ag and Al covetics show bonding between C and the metal. EELS mapping of the C-K edge and high resolution lattice images show that the graphene-like regions form ribbons with epitaxial orientation with the metal lattice of Ag and Al. The temperature dependences of the resistivites of Ag and Cu covetics are similar to those of the pure metals with only slight increase in resistivity. Films of Cu covetic deposited by e-beam evaporation and PLD show higher transmittance and resistance to oxidation than pure metal films of the same thickness indicating that copper covetic films can be used for transparent electrodes.

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