Nanocomposites and nanomaterials

Influence of carbon-additives on the Raman spectra of graphene-like MoS_2

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The vibrational modes of MoS_2, other transition metal dichalcogenides and BN, due to the presence of different atoms and dipole character of vibrations manifest themselves as well in Raman, and IR spectra, however these materials have significantly richer properties than graphene. We have studied Raman (λ_{ex}= 632.8 nm) and infrared spectra of MoS_2 nanocrystallites (NCs) with sizes (4-5) x20 (40-50) nm and a thickness of 6-8 layers as well as single- to several layers films of MoS_2 on Si substrate. The effect of the addition of carbon (1-2%), which can intercalate MoS_2 or form monolayers of graphene on the surface of MoS_2 NCs has been investigated. The size increasing of the unit cells no less than 4 times for a set of NCs has been found; that leads to the appearance in the vibrational spectra the acoustic modes $TA_{1,2}$ = 146-194 cm^{-1} and LA = 236 cm^{-1}, as well as the corresponding low-frequency components. For single- and few-layer films a series of overtones $\nu n \approx n\nu 0$, where n = 2–7, and low frequency vibrations of monolayer (ν_0 = 41-55 cm^{-1}) of MoS_2 have been observed additionally.