

Raman Scattering of Composite TiS₂/C

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Raman scattering of light is a quite informative method that allows measurement of the molecules and crystals oscillation frequency. This opens up opportunities for substance identification and research of transformations that occur in it under external influence.

Two intense phonon bands of the first order G and D at $\sim 1590 \text{ cm}^{-1}$ and 1353 cm^{-1} (Fig. 1) were fixed in the spectra of micro-Raman origin and laser irradiated TiS₂/C samples, whose appearance is caused by one-phonon process of inelastic light scattering on valence fluctuations sp²-bonded carbon atoms and scattering at structure defects, respectively.

The relative integrated intensity of the bands I_G / I_D and their half-width reflect the degree of material structural disordering. In addition, the average size of nanocrystalline carbon regions (nc-C) is proportional to bands I_G / I_D relation and in our case it is 8 nm.

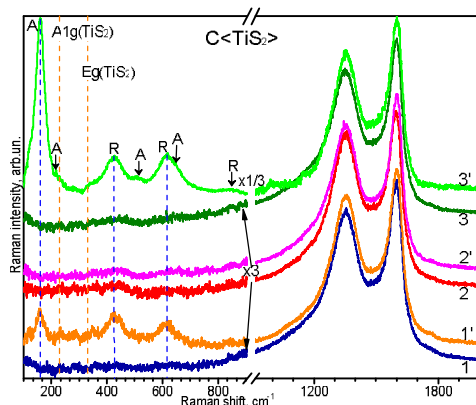


Image 1. Micro-Raman spectra of composite TiS₂/C: 1, 2, 3 (1', 2', 3') – pure mechanical mixtures (laser radiated) at a ratio TiS₂:C = 10:90, 20:80, 30:70 (%), respectively $\lambda_{36} = 488 \text{ nm}$, $T = 300\text{K}$.

belongs to the tetragonal symmetry and corresponds to space group symmetry D_{4h}(I₄/amd). From the group-theoretic analysis it is known that for this structure in Raman spectra there are six active optical modes: A_{1g} (507 cm^{-1}) + 2B_{1g} (399 cm^{-1} and 519 cm^{-1}) + 3E_g (144 cm^{-1} , 197 cm^{-1} and 639 cm^{-1}).

Thus, the local areas with the structure of rutile and anatase in irradiated TiS₂/C composites are formed, and improving the structure of nanocrystalline carbon surface areas.

Compared with the original sample for the laser irradiated samples, a decrease of left side of D band at $\sim 1208 \text{ cm}^{-1}$, whose appearance is caused by mixing sp²-sp³ bonds on the periphery of the crystallites or C-C and C = C valence fluctuations of polyene-like structures.

After laser treatment of TiS₂/C samples new phonon bands are appearing in micro-Raman spectra that are responsible for the inclusion of TiO₂ structural phase (Fig. 1 - spectra 1', 3'). It is known that the most thermodynamically stable structure is TiO₂ with anatase and rutile structure. Anatase structure