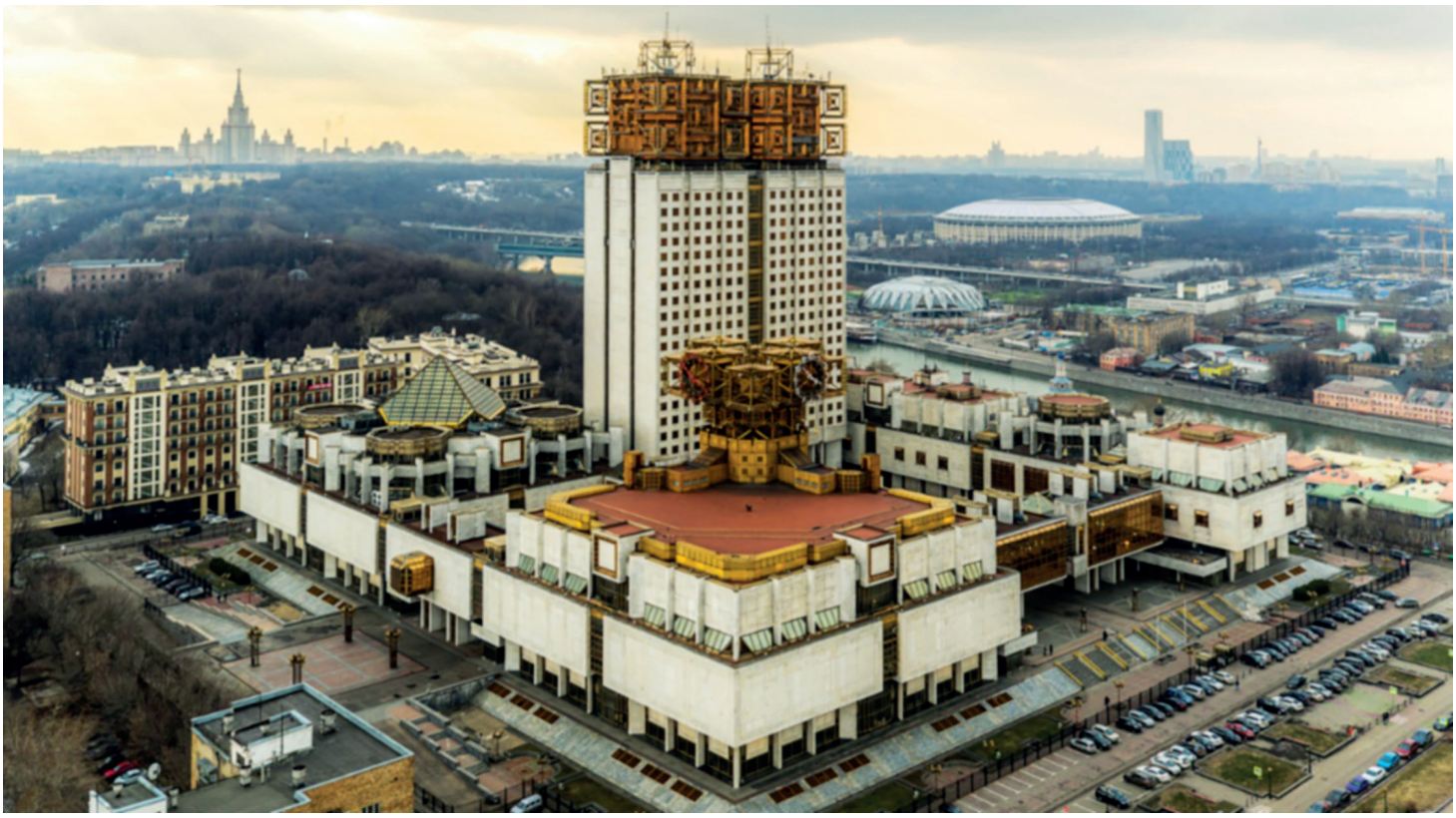

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Enhanced Raman scattering in amorphous carbon films under cw laser irradiation

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Ultra-thin amorphous carbon (a-C) films (10-100 nm) are well established protective coatings of optical fibers that operate in harsh environment. The formation of hydrogen- and oxygen-containing functional groups reduces the hermeticity of a-C coatings, and therefore, monitoring these impurities is of great importance [1]. In this work, we propose an approach for detecting of the hydrogen- and oxygen- containing functional groups in carbon composites.

In this work we observed anomalous features of Raman spectra of amorphous carbon films as the temperature varied. In particular, the magnitude of I_{aS}/I_S for the *G* band at room temperature was 1/10, whereas the value predicted by the Boltzmann law is 1/600 [2]. Moreover, the profile of the anti-Stokes spectrum is not mirror-symmetric with respect to the Stokes spectrum. We considered that this behavior can be attributed to the resonance Raman scattering and photo-induced heating of the a-C films under continuous wave laser excitation.

We first estimated the contributions of photo-heating in of I_{aS}/I_S ratio by investigating the Raman spectra at different laser power. The resonance Raman scattering was estimated by introducing a resonance factor as a ratio of anti-Stokes to Stokes scattering cross-sections [3]. We attribute the observed resonance Raman scattering with defect-induced modification of joint electronic density of states of a-C [4]. Thus, factor can be used to assess the degree of enrichment/depletion of a-C with functional groups (hydroxyl, epoxy, carbonyl and carboxyl).

Understanding the physical mechanisms of the anomalous anti-Stokes Raman scattering will improve Raman thermometry.

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