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In -situ Raman thermometry as a tool to study Low temperature plasma – material surface interactions[1] CARLA BERROSPE RODRIGUEZ, JOSEPH SCHWAN, LORENZO MANGOLINI, University of California, Riverside — Low temperature plasmas are commonly used to grow and process high melting point materials. The synthesis of these offers advantages over other production methods, which are used for energy storage, highly sensitive detection, disease diagnosis and treatment, among others. The heating mechanisms occurring at the interface between these plasmas and materials are not fully understand and comprehending this, is crucial to further improve plasma-driven processes. We present for the first time an insight of non-thermal plasma surface interaction with nanoparticles by means of in-situ Raman spectroscopy. We tested this method on chemical vapor deposition carbon thin films, carbon nanoparticles and multilayered graphene, where the temperature of the particles immersed in the plasma was obtained by Raman thermometry. The temperature of the materials showed a significant dependence on the plasma gas composition, where higher values were observed in pure argon compared to hydrogen diluted argon. Carbon nanoparticles presented higher temperature compared to graphene and carbon films, due to is lower thermal conductivity. A temperature up to 570 K for a 20 W coupled power was reached, this means 6 times the initial temperature (320 K, induced by the laser). Finally, heat transfer modeling was carried out to discard temperature increment due to gas heating. This non-invasive laser-based method opens the opportunity for a synthesis monitoring tool in real time.

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