Abstract for NANOMAN2024(500 words) The Specialized SiO_2/TiO_2 Multilayered Coatings for Macroscopic Optical Force Sensors

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Multilayered coatings are routinely used in optical devices to achieve their functions. In this study, a specialized multilayered coating is proposed which composed of alternating layers of SiO2 and TiO2 to create spectral gaps for varied incidents of high-power laser. The multilayered coating helps to achieve low-thermally induced fluctuations and effective optical force, which essentially ensures the performance of the optical force sensor. A theoretical framework for the analysis of the optical force in the multilayered coating is developed based on the Lorentz law of classical electrodynamics and the boundary conditions at the periodic interfaces. It is compatible with different numbers of layers. And the direct measurement of the coating's performance is demonstrated. The experiment results show that the multilayered coating can be employed to generate 132 nN optical force at 1064 nm laser illumination, which is consistent with numerical simulations. The research provides a new methodology for the control of optical forces and has a critical importance in the application of optical force on a macroscopic scale.