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Strong coupling between light and subwavelength microstructure of the carbon aerogels AI DU, WEI SUN, YU FENG, HONGQIANG WANG, JUN SHEN, BIN ZHOU, Tongji University — Owing to its diverse compositions and unique properties which could fill the gap between condensed and gas-state matter aerogels are now regarded as a new state of matter. Recently, we found that subwavelength microstructure obviously affect the reflectivity. The subwavelength structure of carbon aerogels was controlled by adjusting the sol-gel process and carbonizing the resorcinol-formaldehyde aerogels. A roughly positive correlation between reflectivity and density was found. Moreover, the smaller the skeleton and pore size is, the lower the reflectivity is. We got the minimum reflectance about 0.19 %. Carbon aerogels were activated using CO_2 at 1000^{o}C to induce the micropore (<2 nm) without changing the density. The reflectivity of carbon aerogels decreased sharply after activation, indicating that the structure much smaller than wavelength could affect the light propagation. We attribute this behavior to the indirect electromagnetic-electronmicrostructure interaction. The mean free path λ of the electrons strongly decreases when the conductor is smaller than λ, leading to an extra absorption besides considering the Joule's effect In addition we induced nanostructured metal to increase the hot electron loss, to further reduce the reflectivity.

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