Thermally-induced Spectral Tunability on DBR-based Infrared Emitters

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Spectrally selective perfect absorbers and thermal emitters in the infrared spectral region are key components for the development of modern spectroscopic applications such as infrared sensors, radiative heaters and thermophotovoltaics [1,2]. In this regard, one of the most effective approaches to achieve ultra-narrowband perfect absorbers and emitters relies on the interference effect arising from multiple reflected beams on planar resonant cavities loaded with distributed Bragg reflectors (DBR) [3]. Since the optical path length of the reflecting beam in the cavity as well as in the DBR is the key factor to determine the resonance wavelength and the band width of the absorbers, refractive indices and extinction coefficients of the materials play crucial roles in this type of devices.

In this work, we examined the tunability of the resonance wavelength of DBR-based narrowband perfect absorbers and emitters in the infrared region. The tunability in the refractive index of the component materials in the DBR/LaB_6 emitter system [3] was embodied by the dielectric property change thermally induced by the phase change in Si (a-Si) layers, in the SiO_2/Si-DBR component. By thermally annealing the *"as sputtered"* structure, we can induce a phase change in a-Si layers to polycrystalline/crystalline Si layers. This change of phase leads to a continuous modification of the optical properties of the DBR structure, which can be used to finely adjust the resonant wavelength of the final device (**Fig. 1**). This strategy can be further extended to many other amorphous materials and provides an alternative way to precisely tune the operation wavelength of DBR structures, thus representing a step forward towards the realization of accurate perfect absorber sensors, thermal emitters and thermophotovoltaic devices.

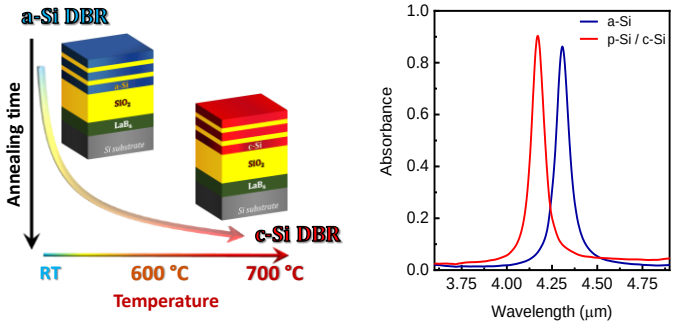

Figure 1: Spectral tuning of DBR-based perfect absorber structures by thermally induced phase transitions changes

References:

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