Spectral tunability of the absorption resonance of DBR-based infrared thermal emitters

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Spectrally selective thermal emitters in the infrared spectral region are key components for the development of modern spectroscopic applications such as infrared sensors, radiative heaters and thermophotovoltaic devices [1, 2]. One of the most effective approaches to achieve ultra-narrowband thermal emitters in this region relies on the fabrication of perfect absorber structures based on interference effects from planar resonant cavities loaded with distributed Bragg reflectors (DBR) [3]. Due to the optical interference nature of these systems, refractive indices and extinction coefficients of the materials play crucial roles to determine the absorption resonance wavelength and its bandwidth. In this work, we apply a thermal approach to achieve the fine tuning of the resonance wavelength of (Si/SiO_2)DBR/LaB_6 narrowband thermal emitters. In particular, this tunability was embodied by a change of the dielectric property of the Si layers by a thermal-induced change of phase from amorphous to polycrystalline Si. This change of phase leads to a continuous modification of the optical properties of the DBR structure, which can be successfully used to finely adjust the resonance 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 not only thermal emitters, but also accurate spectrally selective sensors and thermophotovoltaic devices.

REFERENCES

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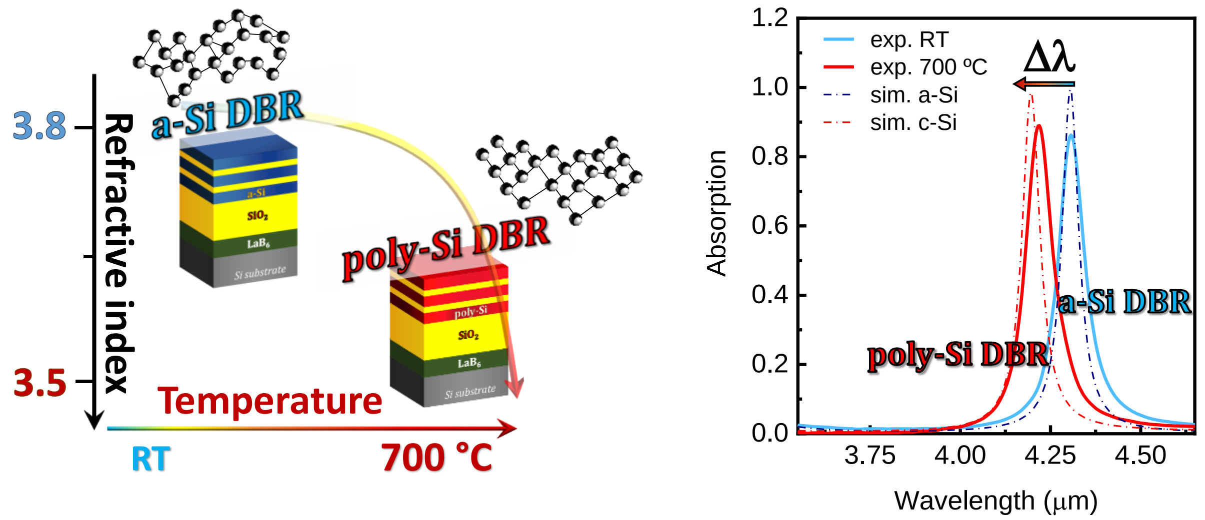

Figure 1: Spectral tuning of the absorption resonance of DBR-based thermal emitters by a thermally induced phase transition from amorphous Si (room temperature) to polycrystalline Si (up to 750ºC).