Development of Perfect absorbers by LaB_6-based Metal-Insulator-Metal Stripes

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Searching for practical plasmonic materials for state-of-the-art infrared applications has been gaining interest in recent years [1]. Conventional noble metals such as Au, Ag, Al, Cu are well-known plasmonic materials because of their excellent plasmonic properties in the ultraviolet-visible region. However, these metals are not suitable for high-temperature infrared applications due to their low thermal stability.

With a high melting point of about 2200°C, LaB_6 is one of the candidates for novel plasmonic materials because of its electrical, optical properties, low work function [2]. Besides, more heat-resistant than conventional metals, LaB_6 is a refractory ceramic material and could be used for infrared thermal application and near infrared plasmonics.

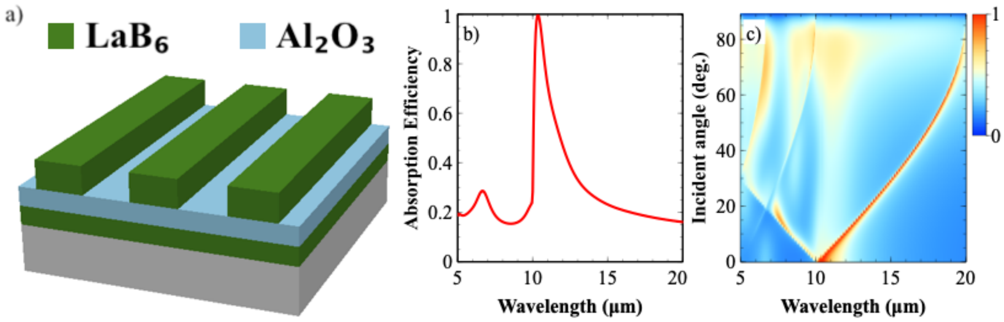

Figure 1. a) Scheme of LaB_6 configured by MIM Stripe structure; Simulated absorption efficiency with resonant wavelength of 10.2µm (b) and angular dependent absorption (c) of LaB_6 MIM Stripe structure.

In this work, taking advantage of LaB_6, we designed the Metal-Insulator-Metal (MIM) Stripe structure for potential use in thermal emitters. Using sputter deposited LaB_6 films and Reactive Ion Etching (RIE), we successfully fabricated the perfect absorber devices, which could be operated at high temperatures up to 600°C in the atmospheric condition. Furthermore, by varying structural parameters, such as periodicity or stripe length, we can freely design the resonant wavelength in the mid-IR region. The simulated and experimental results were in reasonable agreement, encouraging us to design and fabricate the optical devices based on this material.

References:

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