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## Well-designed nano-metal/dielectric film structures fabricated by the advanced multiple-guns sputtering system to achieve high photon-to-heat conversion efficiency in the broad solar radiation region

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Among film deposition technologies, the advanced multiple-guns sputtering system has the unique advantage of features to grow a well-designed nano-metal/dielectric film structure in high quality control. In the sputtering process, only pure metal and dielectric materials with one type of inert gas are used to control precisely the thickness of each layer, resulting in the best optical absorption spectra to be more feasibly tuned and achieved with a perfect match to the theoretical ones. By optimal matching of the optical constants and thickness of each layer in the structure, the high optical absorption of averaging > 95% can be realized in the main solar spectral region. The advanced sputtering system has been used to fabricate the multi-layered metal/dielectric film structures with 4-8 layers to achieve high and broadband efficiency of photon-to-heat conversion with low thermal emittance and excellent thermal stability in the solar radiation region to make them particularly suitable for applications under medium and high temperature conditions. The results shown in the work will stimulate more studies on high efficiency solar selective absorber devices to be put into wider applications in the future.

Reference:

[1] W. X. Zhou, et al, Optics Express 20: 28953 (2012).

[2] M. H. Liu, et al, Optics Express 22: A1843 (2014).

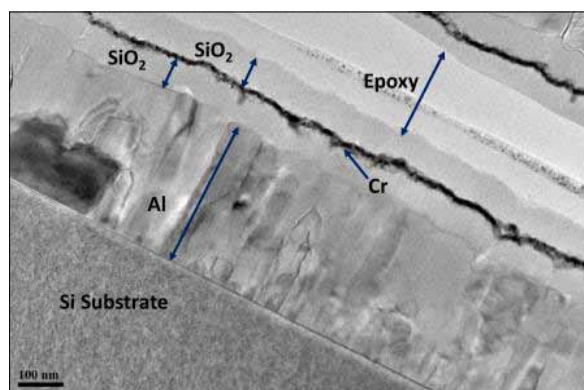


Fig. 1. TEM image of the 4-layered (Cr/SiO<sub>2</sub>) sample sputtered on the Si substrate.

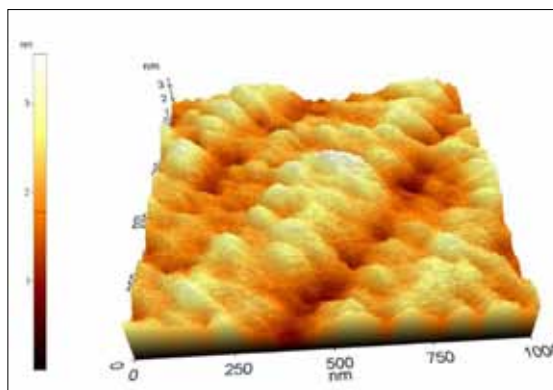


Fig. 2. Average roughness (0.44nm) of the Au film sputtered on the Si substrate.