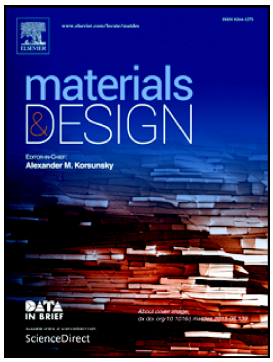
Accepted Manuscript



Improved optical properties of switchable mirrors based on Pd/Mg-TiO2 films fabricated by magnetron sputtering

Yue Liu, Juan Chen, Liming Peng, Jingyu Han, Nanxiang Deng, Wenjiang Ding, Weifan Chen

PII: S0264-1275(18)30102-3
DOI: https://doi.org/10.1016/j.matdes.2018.02.023
Reference: JMADE 3690

To appear in: *Materials & Design*

Received date: 13 November 2017
Revised date: 6 February 2018
Accepted date: 7 February 2018

Please cite this article as: Yue Liu, Juan Chen, Liming Peng, Jingyu Han, Nanxiang Deng, Wenjiang Ding, Weifan Chen , Improved optical properties of switchable mirrors based on Pd/Mg-TiO2 films fabricated by magnetron sputtering. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jmade(2018), https://doi.org/10.1016/j.matdes.2018.02.023

Improved optical properties of switchable mirrors based on Pd/Mg-TiO_2 films fabricated by magnetron sputtering

Yue Liu,[a] Juan Chen,[a]* Liming Peng,[a] Jingyu Han,[a] Nanxiang Deng,[a] Wenjiang Ding[a], Weifan Chen[b]

a National Engineering Research Center of Light Alloy Net Forming and State Key Laboratory of Metal Matrix Composite, School of Materials Science and Engineering, Shanghai Jiao Tong University, 200240, Shanghai, P.R. China
b School of Materials Science and Engineering, Nanchang University, 330031,Nanchang, P.R. China

*Corresponding author: Juan Chen
Email: juanchen@sjtu.edu.cn
Phone number: 086-21-54742627
Fax number: 086-21-34202794

Abstract: For the past two decades, the reported magnesium-based gasochromic switchable mirrors have been limited to magnesium alloys. Herein, inspired by the excellent catalytic property of TiO_2 for the magnesium-hydrogen reaction, the novel gasochromic switchable mirrors based on Pd/Mg-TiO_2 films were fabricated by magnetron sputtering and their optical properties, microstructures and structure-function relationship were investigated in this study. The results show that the mirror based on Pd/0.9Mg-0.1TiO_2 film exhibits larger optical dynamic range at visible wavelengths and excellent structural recovery even after 100 cycles of hydrogenation and dehydrogenation compared with Pd/Mg film. The brookite TiO_2, crystalline Mg and some amorphous phases coexist in the Mg-TiO_2 layer of Pd/0.9Mg-0.1TiO_2 film with no trace of Pd. Interestingly, the TiO_2 nanocrystal clusters are distributed in stripe among Mg matrix. In contrast, the Pd/0.63Mg-0.37TiO_2 film consists of crystalline Mg and $MgTi_2O_5$ phase, where $MgTi_2O_5$ phase is derived from the reaction of superfluous TiO_2 with a part of Mg and deteriorates the optical properties of the mirror dramatically. In summary, this work offers a novel strategy for improving optical performance of Mg-based switchable mirrors by introducing metal oxides into switchable layer and uncovers a broad field to be explored.

Keywords: Switchable mirrors, Mg-TiO_2 films, Optical properties, Microstructure