

Optically Active TiO₂:Er Thin Films Deposited by Magnetron Sputtering

Anna Kot ^{1,*}, Marta Radecka ¹, Dominik Dorosz ¹ and Katarzyna Zakrzewska ²

¹ Faculty of Materials Science and Ceramics, AGH University of Science and Technology, al. A. Mickiewicza 30, 30-059 Kraków, Poland; radecka@agh.edu.pl (M.R.); ddorosz@agh.edu.pl (D.D.)

² Faculty of Computer Science, Electronics and Telecommunications, AGH University of Science and Technology, al. A. Mickiewicza 30, 30-059 Kraków, Poland; zak@agh.edu.pl

* Correspondence: annakot@agh.edu.pl

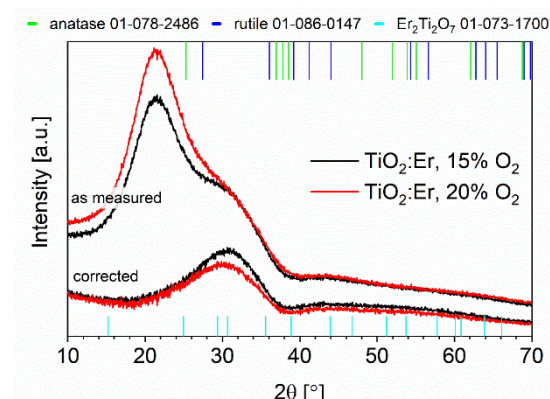


Figure S1. XRD patterns (as measured and after correction) recorded for the Er-doped thin films deposited at 15% O₂ (black curve) and 20% O₂ (red curve). Correction was done by subtraction of recorded substrate pattern. Positions of reference peaks are marked with vertical lines. Reference patterns are from anatase 01-078-2486, rutile 01-086-0147, and Er₂Ti₂O₇ 01-073-1700 cards.

Citation: Kot, A.; Radecka, M.; Dorosz, D.; Zakrzewska, K. Optically Active TiO₂:Er Thin Films Deposited by Magnetron Sputtering. *Materials* **2021**, *14*, 4085. <https://doi.org/10.3390/ma14154085>

Academic Editor: Roberta G. Toro

Received: 15 June 2021

Accepted: 14 July 2021

Published: 22 July 2021

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

Table S1. Grain size analysis.

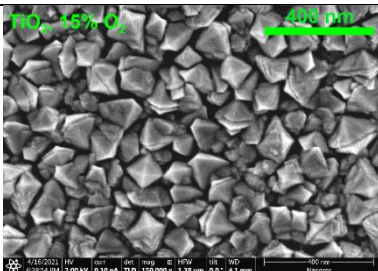
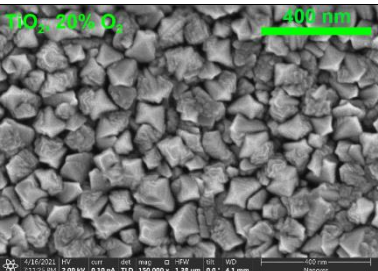
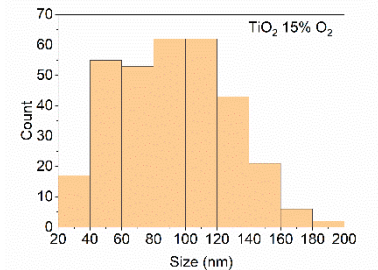
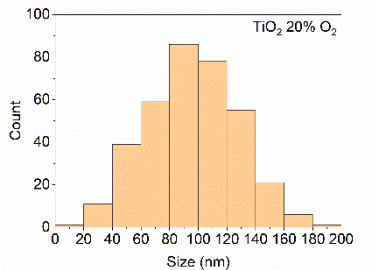
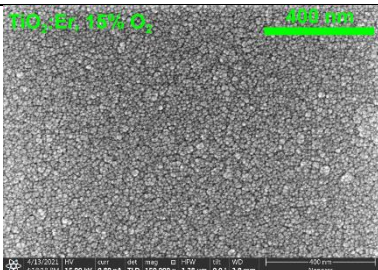
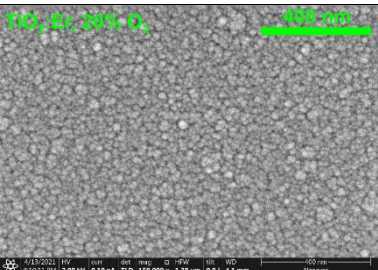
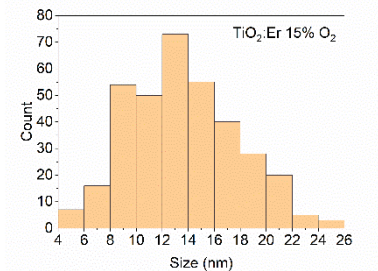
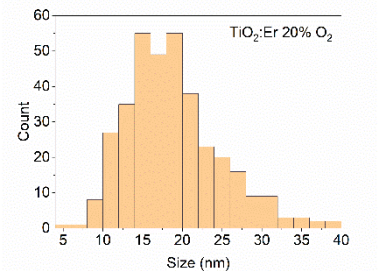
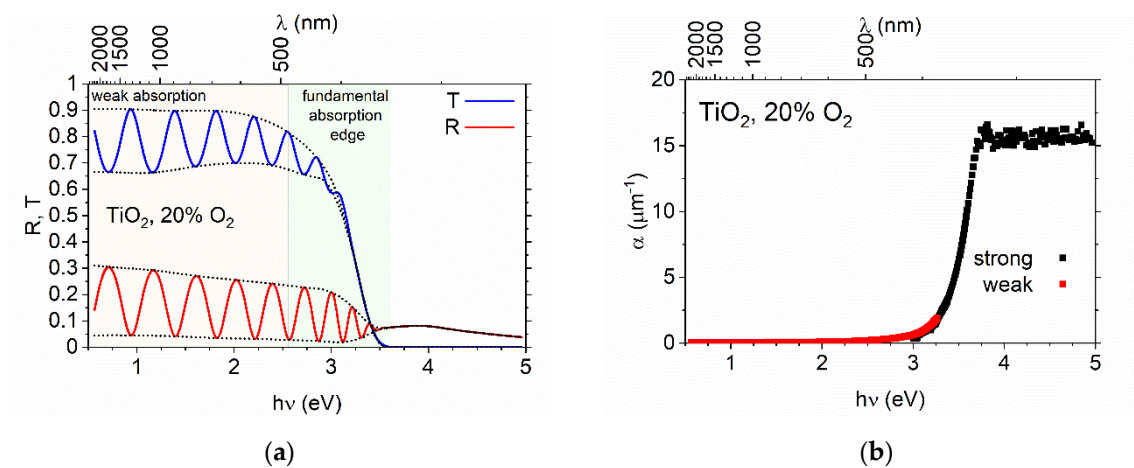
	15% O ₂	20% O ₂
TiO ₂		
		
	N total	321
	Mean	92.44 nm
	Standard deviation	34.97 nm
	Average grain size	92±35 nm
TiO ₂ :Er		
		
	N total	351
	Mean	13.61 nm
	Standard deviation	4.11 nm
	Average grain size	14±4 nm

Table S2. XPS results analysis.

	Peak position (eV)	Area	FWHM
TiO ₂ , 20% O ₂			
Ti ³⁺ : 2p _{3/2}	457.6	237.0	2.73
Ti ³⁺ : 2p _{1/2}	462.7	71.6	1.45
Ti ⁴⁺ : 2p _{3/2}	458.6	2594.3	0.96
Ti ⁴⁺ : 2p _{1/2}	464.3	2060.4	2.34
TiO ₂ :Er, 20% O ₂			
Ti ³⁺ : 2p _{3/2}	457.3	38.6	1.13
Ti ³⁺ : 2p _{1/2}	462.7	18.0	0.96
Ti ⁴⁺ : 2p _{3/2}	458.5	1211.0	1.00
Ti ⁴⁺ : 2p _{1/2}	464.3	856.5	2.38
Er ³⁺ : 4d _{5/2}	168.3	190.8	1.46
Er ³⁺ : 4d _{3/2}	170.1	343.3	3.04

**Figure S2.** Optical properties analysis of TiO₂ thin films deposited at 20% O₂ - spectral dependence of: (a) the transmittance T and reflectance R coefficients with envelopes; (b) the calculated absorption coefficient α.