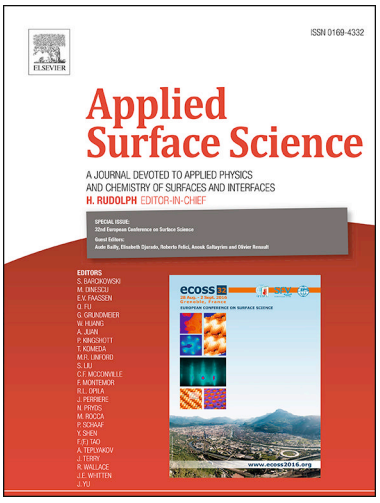
Accepted Manuscript



Full Length Article

Oxygen Detection Using Nanostructured TiO_2 Thin Films Obtained by the Molecular Layering Method

Artem S. Mokrushin, Elizaveta P. Simonenko, Nikolay P. Simonenko, Karina T. Akkuleva, Vladymir V. Antipov, Natalia V. Zaharova, Anatolii A. Malygin, Kirill A. Bukunov, Vladimir G. Sevastyanov, Nikolay T. Kuznetsov

PII: S0169-4332(18)32351-1
DOI: https://doi.org/10.1016/j.apsusc.2018.08.208
Reference: APSUSC 40245

To appear in: *Applied Surface Science*

Received Date: 29 March 2018
Revised Date: 19 July 2018
Accepted Date: 23 August 2018

Please cite this article as: A.S. Mokrushin, E.P. Simonenko, N.P. Simonenko, K.T. Akkuleva, V.V. Antipov, N.V. Zaharova, A.A. Malygin, K.A. Bukunov, V.G. Sevastyanov, N.T. Kuznetsov, Oxygen Detection Using Nanostructured TiO_2 Thin Films Obtained by the Molecular Layering Method, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.08.208

Oxygen Detection Using Nanostructured TiO_2 Thin Films Obtained by the Molecular Layering Method

Artem S. Mokrushin[1*], Elizaveta P. Simonenko[1], Nikolay P. Simonenko[1], Karina T. Akkuleva[2], Vladymir V. Antipov[2], Natalia V. Zaharova[2], Anatolii A. Malygin[2], Kirill A. Bukunov[3,4], Vladimir G. Sevastyanov[1], Nikolay T. Kuznetsov[1].

[1]Kurnakov Institute of General and Inorganic Chemistry of the Russian Academy of Sciences, 31 Leninsky pr., Moscow, 119991, Russia, Fax/Tel: +7 495 954 4126, E-mail: artyom.nano@gmail.com*, ep_simonenko@mail.ru, n_simonenko@mail.ru, v_sevastyanov@mail.ru, ntkuz@igic.ras.ru.

[2]State Institute of technology Saint-Petersburg Russia, 26 Moskovsky pr., Saint-Petersburg, 190013, Russia, Fax/Tel: +7 812 494 9339, E-mail: akkulevakarinka@gmail.com, wantipov@yandex.ru, zakharova@lti-gti.ru, malygin@lti-gti.ru.

[3]Faculty of Physics Lomonosov Moscow State University, 1-2 Leninskie Gory, 119991, Moscow, Fax/Tel: +7 495 939 2453, E-mail: bukunov.kirill@physics.msu.ru.

[4]Skobeltsyn Institute of Nuclear Physics Lomonosov Moscow State University, 1-2 Leninskie Gory, 119991, Moscow, Fax/Tel: +7 495 939 2453, E-mail: bukunov.kirill@physics.msu.ru.

Abstract Using the molecular layering method (ML), nanostructured TiO_2 films have been synthesized that are promising for detecting oxygen over a wide range of concentrations at low operating temperatures of 150-300°C. It has been shown that an anatase thin film is formed; the particle size is 34.9 ± 3.1 nm. It has been established that it enables the highly responsive detection of oxygen (R_{O2}/R_{Ar} up to 26.6 at a temperature of 200°C and O_2 content of 10%). The influence of operating temperature on the response values, and response and recovery time, have been studied. It has been shown that response magnitude slightly depends on humidity, but at 100% humidity response time and signal recovery time increase significantly. A sufficiently high degree of selectivity has been found when detecting oxygen, in comparison with other analyte gases (CO, H_2, CH_4 and CO_2).

Keywords: method of the molecular layering (ML), atomic layer deposition (ALD), gas sensor, TiO_2, titanium dioxide, humidity

1. Introduction

Vapour deposition methods, to obtain nanostructures for resistive chemical gas sensors, including oxygen sensors, have been applied for a long time - over two decades [1]–[3].