Development of Solid State UV Detector Using Commercial TLD and $Ln_2O_3:RE^{3+}$ (Ln=Y, La, Gd; RE=Tm, Tb, Eu, Er, Pr)

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To my love mother
and my wife

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Abstract

Dosimetry of terrestrial ultraviolet (UV) using thermoluminescence (TL) material is an attractive method for a number of reasons. Such as the low cost per phosphor, the possibility to produce them in laboratory with simple facilities, the absence of any associated electronics at the site of measurement and the small size of solid phosphors which can also be used in personal dosimetry.

In this research, we are searching for a suitable lanthanide oxide powder and commercial TLD material that can detect solar UV radiation using intrinsic method. The investigated lanthanide oxide powders include Gd_2O_3, La_2O_3 and Y_2O_3 doped with different rare earth elements. They were sintered in air at temperature of ~1200°C. The studied commercial TLD include TLD-100H, TLD-700H, TLD-200, TLD-500 and TLD-900. These materials were exposed to UV lamp and sunlight to check their response to UV radiation. Some of them such as $Gd_2O_3:Pr^{3+}$, $Y_2O_3:Pr^{3+}$ and TLD-400 showed no response to this radiation. TLD-500 and TLD-900 showed high sensitivity to UV radiation. TLD-900 has a linear response to UV lamp and sunlight being similar to UV photometer in its response.

In general, the glow peak at low temperature is not stable in the dark at room temperature. Only the glow peak at high temperature is stable and can be used in UV dosimetry. It has been found that, ordinary light is also play the main role in the TL fading of this material. It can remove ~100% of TL intensity caused by UV radiation.

Abstrak

Pengukuran paras sinaran UV di permukaan bumi mengunakan bahan termoluminesens (TL) merupakan salah satu kaedah yang baik kerana kos pembuatanya yang rendah, dapat dihasilkan dengan mengunakan peralatan makmal yang ringkas. Di samping saiznya yang kecil, dedahan boleh dilakukan tanpa sebarang peralatan elektronik.

Serbuk lantanida oksida dan bahan komersial TLD yang boleh mengesan sinaran UV matahari menggunakan kaedah intrinsik dikaji. Kajian dilakukan ke atas serbuk lantanida oksida termasuk Gd_2O_3, La_2O_3 dan Y_2O_3 yang dopkan dengan unsur-unsur nadir bumi yang berlainan. serbuk lantanida oksida dipanaskan di dalam udara pada suhu 1200 ^oC. Bagi TLD komersial, kajian dijalankan ke atas TLD-100H, TLD-700H, TLD-200, TLD-500 dan TLD-900.

Bahan-bahan termoluminesens ini didedahkan kepada lampu UV dan sinar matahari untuk melihat keupayaan mengesan sinaran UV. Ada antaranya seperti $Gd_2O_3:Pr^{3+}$, $Y_2O_3:Pr^{3+}$ dan TLD-400 tidak menunjukkan sebarang tindakbalas langsung. Sebaliknya, TLD-500 dan TLD-900 juga menunjukkan kepekaan yang tinggi terhadap sinaran UV. TLD-900 menunjukkan tindakbalas linear terhadap sinaran dari lampu UV dan matahari, iaitu sama seperti dengan respon dari meter UV.

Abstrak

Secara amnya, puncak bara pada suhu rendah adalah tidak stabil apabila disimpan pada suhu bilik dalam gelap. Hanya puncak bara pada suhu tinggi adalah stabil dan boleh digunakan dalam dosimetri UV.

Cahaya biasa juga didapati memainkan peranan dalam kelunturan TL kekaburan dalam bahan ini. Ia boleh menyahkan 100% keamatan TL yang disebabkan oleh sinaran UV.

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