Sensitive mechanoluminescence from Eu^{2+},Tm^{3+} co-doped $Sr_3Al_2O_5Cl_2$ phosphors

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二.成果简介：

In this study, sensitive mechanoluminescence (ML) phosphors $Sr_3Al_2O_5Cl_2$:Eu^{2+},Tm^{3+} have been developed. The effect of co-doped Tm^{3+} ions on the ML properties of the samples were investigated. The results showed that the ML emission, afterglow emission and photoluminescence were similar all consisted of a broad band peated at 610 nm, which can be ascribed to the $4f^65d^1 \rightarrow 4f^7$ transition of Eu^{2+}. This result indicated that the ML also originated from the Eu^{2+} emitting center not the Tm^{3+} ions. When the content of Tm^{3+} reached 0.05, sensitive ML intensity of the sample arrived at the strongest under the compressive load of 10–50N. In addition, the obtained results also showed that the deep traps can provide the possibility to produce long time stable ML emission under strong compressive load of 10–800N. Even after 120 min, stable obvious ML signals can be observed. All these results suggested that $Sr_3Al_2O_5Cl_2$:Eu^{2+},Tm^{3+} phosphors possessed great potential in precious detection of weak stress and long time stable ML detection.

.三. 主要研究内容及创新点：

Contents and innovations: Via controlling the doped Tm^{3+} concentrations, the trap concentration and depth of the samples can be regulated systematically. Then the relation between ML sensitivity of the samples and the trap concentration and depth was investigated in order to deduce the possible sensitive ML mechanism. On the basis, this optimal ML materials can be obtained. This investigation will provide some theory support of the design of sensitive ML phosphors and expand the application of the ML sensors in the fields of the precis detection of low stress distribution.

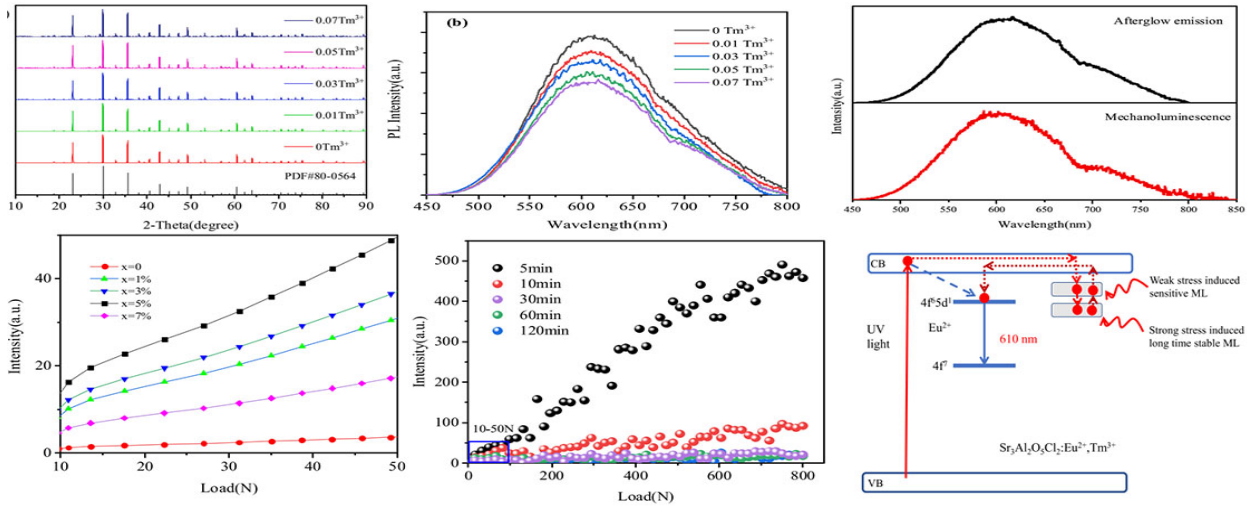


Figure 1. The optical properties and mechanoluminescence mechanisms of $Sr_3Al_2O_5Cl_2$:Eu^{2+},Tm^{3+}

四. 主要研究成果及应用情况

1、2022 年在 SCI 二区期刊《Journal of luminescence》发表论文《Sensitive mechanoluminescence from Eu^{2+}, Tm^{3+} co-doped $Sr_3Al_2O_5Cl_2$ phosphors》。

2、申请（专利申请号：202111383265.0）发明专利 1 项：一种具有橙黄色余辉的应力发光材料及其制备。

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