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**Sr²⁺ substitution for Ca²⁺ and Eu²⁺, Dy³⁺ Co-doping enhance mechanoluminescence of
CaAl₂Si₂O₈ Phosphors**

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Abstract: A series of phosphors (Ca_{1-x}Sr_x)Al₂Si₂O₈:Eu²⁺, Dy³⁺ (x = 0.1, 0.2, 0.3, 0.4, 0.5, 0.8) and Ca_{0.6}Sr_{0.4}Al₂Si₂O₈:yEu²⁺, 2yDy³⁺ (y = 0.005, 0.01, 0.015, 0.02) were prepared. It was found Ca_{0.6}Sr_{0.4}Al₂Si₂O₈:Eu²⁺, Dy³⁺ achieved the highest mechanoluminescence intensity, and the optimal Eu²⁺ and Dy³⁺ co-doping contents were 1% and 2%, respectively. The emission peak of Ca_{0.6}Sr_{0.4}Al₂Si₂O₈:0.01Eu²⁺, 0.02Dy³⁺ was located at 413 nm on ML spectrum, which was similar to the photoluminescence, indicating both mechanoluminescence and photoluminescence were attributed to the 4f⁶5d¹→4f⁷ transition of Eu²⁺. Also Ca_{0.6}Sr_{0.4}Al₂Si₂O₈:0.01Eu²⁺, 0.02Dy³⁺ exhibited an excellent threshold force (130 N) in the extremely broad tested force range (130 - 3,000 N) and kept a nearly perfect linear response, which made it a potential candidate for application of pressure sensors. The introduction of Sr²⁺, Eu²⁺ and Dy³⁺ caused lattice distortion, formation of more defects, and thus generation of more suitable traps to capture the electronic carriers under ultraviolet excitation. Increasing the number of traps and tuning of the trap depth were found to increase the mechanoluminescence response.

Keywords: phosphors; mechanoluminescence; lattice distortion; traps.

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