# *Supplementary materials*

**Synthesis, Crystal Structure and Photoluminescent Properties of Red-emitting $CaAl_4O_7:Cr^{3+}$ Nanocrystalline Phosphor**

Leonid Vasylechko, Vitalii Stadnik, Vasyl Hreb, Yaroslav Zhydachevskyy, Andriy Luchechko, Vitaliy Mykhaylyk, Hans Kraus, Tomasz Wojciechowski and Andrzej Suchocki

The plots labeled Figures S1 – S4 display the absolute and relative sensitivities that can be achieved using various temperature sensing methods based on the luminescence properties of $CaAl_4O_7$: $Cr^{3+}$. The absolute sensitivities are expressed in different units, making meaningful comparisons difficult. On the other hand, the relative sensitivities are expressed in the same units (% $K^{-1}$) and can be compared technically. However, these values can be heavily influenced by the normalization parameter Q used in the calculation, which could potentially lead to inaccurate conclusions. For instance, as shown in the example in Fig. S4, the relative sensitivity achieved by the peak shift technique ( $\Delta v$ ) is orders of magnitude lower than that demonstrated by the intensity ratio technique (F) between 50 and 350 K. However, when considering the achievable uncertainties of different temperature sensing methods (as seen in Fig. 13), the peak shift technique provides better precision above 175 K. Therefore, in this study we compare the performance of different methods based on their temperature uncertainty.

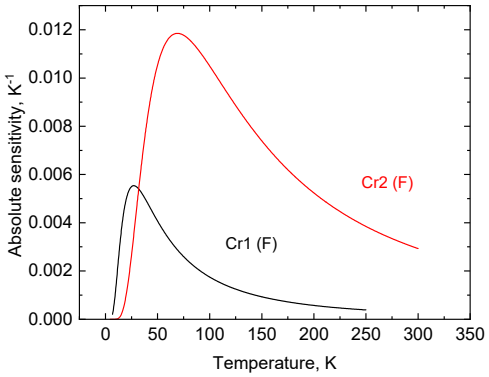


**Figure S1.** Temperature dependence of absolute sensitivity of intensity ratio technique using luminescence of $CaAl_4O_7:Cr^{3+}$

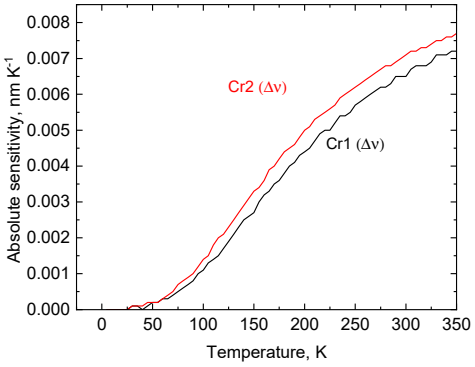


**Figure S2.** Temperature dependence of absolute sensitivity of peak shift technique using luminescence of $CaAl_4O_7:Cr^{3+}$

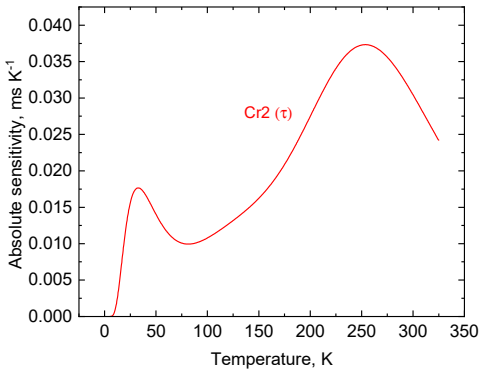


**Figure S3.** Temperature dependence of absolute sensitivity of the decay time technique using luminescence of $CaAl_4O_7:Cr^{3+}$

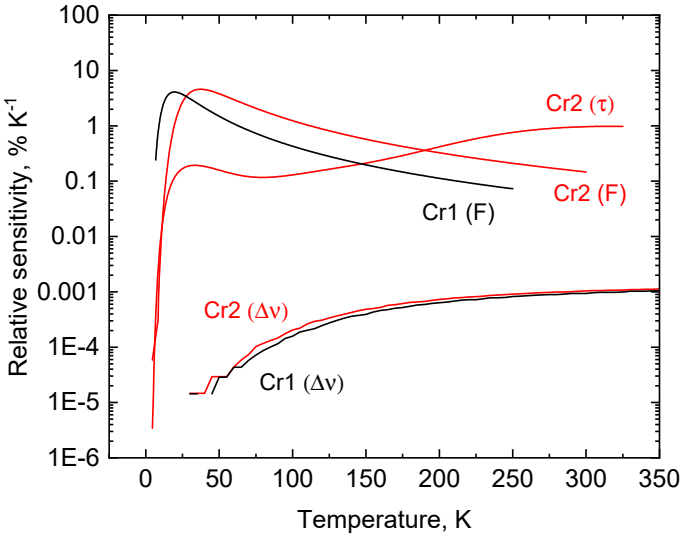


**Figure S4.** Temperature dependences of relative sensitivities demonstrated by different methods of temperature sensing using luminescence properties of $CaAl_4O_7$: $Cr^{3+}$. F - luminescence intensity ratio, $\Delta v$ – spectral shift and τ- decay time constant.