

Long Range Temperature-Sensitive Optical Probe Based on a Europium(III) Benzoylacetate Complex Covalently Bounded to Functionalized Polydimethylsiloxane

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Luminescent lanthanide complexes are widely employed as luminescent probes for several properties due to the $4f$ electronic energy level configuration that confers particular spectroscopic features, such as, long emission lifetime, large pseudo-Stokes shifts and narrow emission bands, which can be used in temperature, oxygen, pH probing^{1,2}. Based on these possibilities, this work deals with the synthesis of a long ranged (83-283 K) temperature sensitive optical probe. The probe was based on a polydimethylsiloxane (PDMS) membrane functionalized with the allyl diphenylphosphine oxide (adppo) ligand through the hydrosilylation reaction in anhydrous toluene. Europium(III) benzoylacetate, $[\text{Eu}(\text{bzac})_3(\text{H}_2\text{O})_2]$ complex was then added in the reaction media for the substitution of the coordinated water molecules by the $\text{P}=\text{O}$ group of the ethyl diphenylphosphine oxide (edppo) ligand grafted onto the PDMS. Finally the europium(III) complex-functionalized PDMS membrane was reticulated with the addition of the tetravinylsilane using a catalyst complex of $\text{Pt}(0)$ ³. Three membranes were synthesized to evaluate the Eu(III) concentration effect on the probe sensibility; 0.1, 0.05 and 0.025 % of $[\text{Eu}(\text{bzac})_3(\text{H}_2\text{O})_2]$ complex was added to the PDMS membrane using 1:2 molar ratio with the addpo present on the PDMS. Membranes are thermally stable until approximately 250 °C and the FT-IR and Raman spectroscopies data confirms that all the adppo ligand has bonded to the membrane. The evaluations of the membranes potentials for temperature probing were performed monitoring the variation of the emission band intensities attributed to $^5\text{D}_0 \rightarrow ^7\text{F}_2$ transitions in the 83-283 K range. All three membranes show a quasi-linear emission intensity dependence with the temperature in this range; the sensibilities of the temperature probing for the three membranes was approximately $0.45\% \text{ K}^{-1}$, indicating that the complex concentration does not interfere on the membrane sensibility. The europium(III) complex chemically bounded to phosphine oxide functionalized-PDMS membranes exhibit potential to be used as temperature probes in a long temperature range.

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