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(54) **HYBRID METAL ORGANIC SCINTILLATOR MATERIALS SYSTEM AND PARTICLE DETECTOR**

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(58) **Field of Classification Search** 549/529, 549/523, 531, 533, 534, 536
See application file for complete search history.

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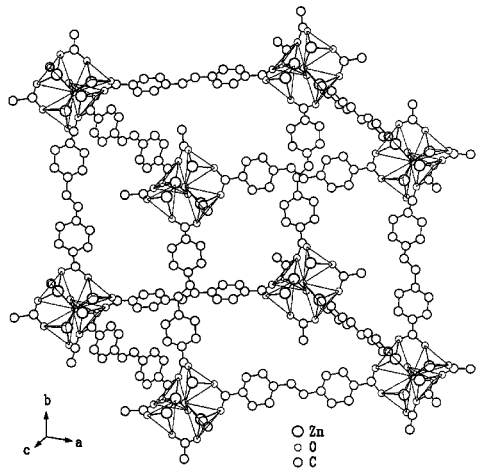
(57) **ABSTRACT**

We describe the preparation and characterization of two zinc hybrid luminescent structures based on the flexible and emissive linker molecule, trans-(4-R,4'-R') stilbene, where R and R' are mono- or poly-coordinating groups, which retain their luminescence within these solid materials. For example, reaction of trans-4,4'-stilbenedicarboxylic acid and zinc nitrate in the solvent dimethylformamide (DMF) yielded a dense 2-D network featuring zinc in both octahedral and tetrahedral coordination environments connected by trans-stilbene links. Similar reaction in diethylformamide (DEF) at higher temperatures resulted in a porous, 3-D framework structure consisting of two interpenetrating cubic lattices, each featuring basic to zinc carboxylate vertices joined by trans-stilbene, analogous to the isoreticular MOF (IRMOF) series. We demonstrate that the optical properties of both embodiments correlate directly with the local ligand environments observed in the crystal structures. We further demonstrate that these materials produce high luminescent response to proton radiation and high radiation tolerance relative to prior scintillators. These features can be used to create sophisticated scintillating detection sensors.

20 Claims, 22 Drawing Sheets