Discovery and Single Crystal Growth of High Entropy Pyrochlores

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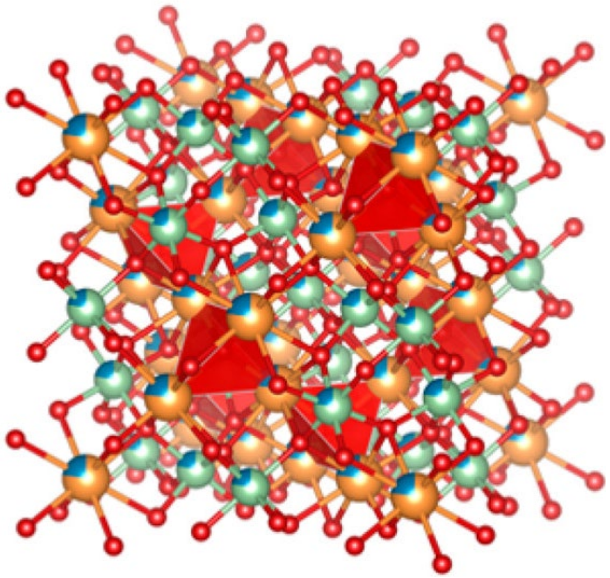
High entropy compounds are an emerging class of functional materials in which short range order enables superior combinations of properties not present in traditional pure or doped structures.

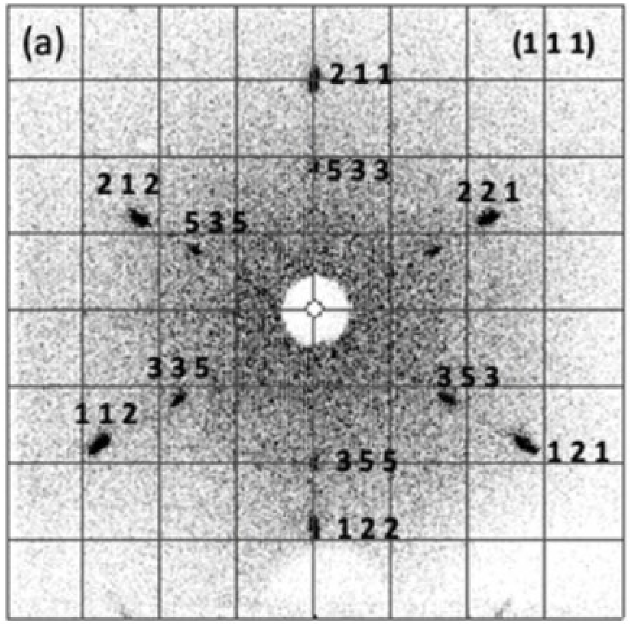
Members of the PARADIM in-house research team discovered and synthesized a family of high entropy oxides with the formula $Mg_2Ta_3Ln_3O_{14}$ (*Ln* = La, Pr, Nd, Sm, Eu, Gd) using the laser optical floating zone technique. This family of materials can host a variety of cation defects and oxygen vacancies that give it a "dial-in" lattice parameter, suggesting applications as a tunable substrate for thin film growth. The crystals' oxygen concentration has direct impact on the optical properties. The ability to visually observe color changes at high temperatures demonstrates the possibility of using this as an active element in optical-based oxygen sensors.

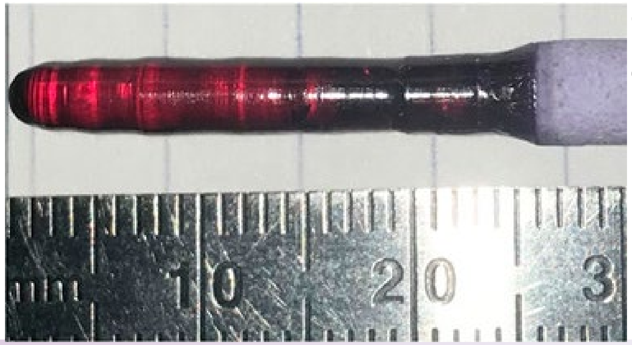
Centimeter-sized single crystals for *Ln* = Nd have been grown—one of the few demonstrated high entropy materials—showing the capabilities of the Laser Diode Floating Zone available to users of PARADIM.

L.A. Pressley *et al.*, *Inorg. Chem.* **59**, 17251 (2020).

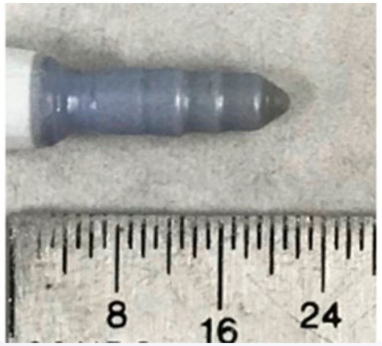
$Mg_2Ta_3Nd_3O_{14}$







Oxygen deficient



Stoichiometric