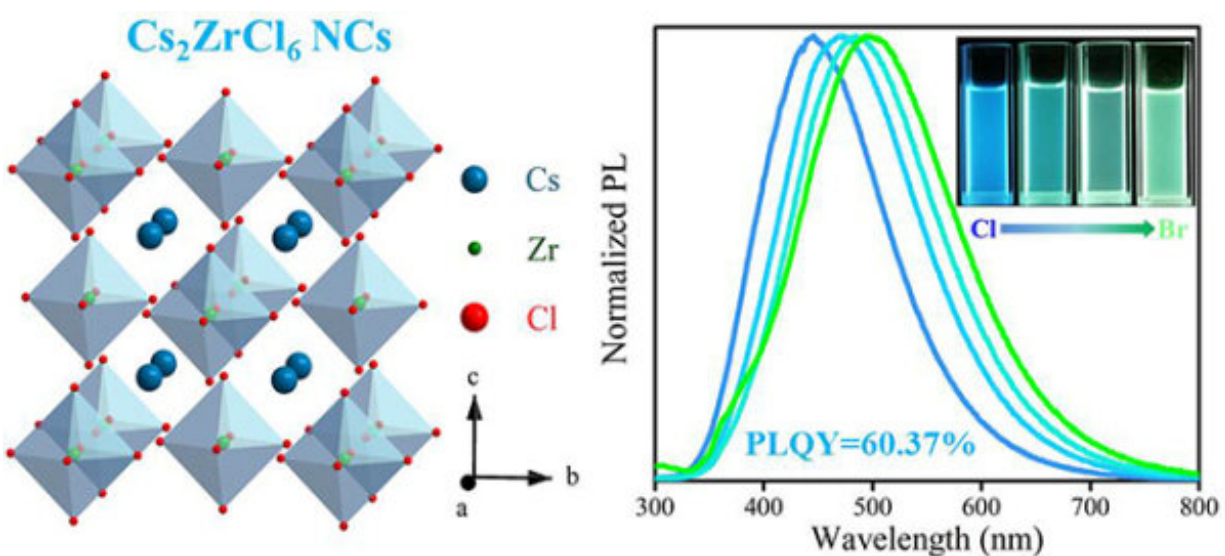


# Scientists synthesize lead-free zirconium-based vacancy-ordered double perovskite nanocrystals

September 7 2020, by Li Yuan



Lead-free perovskite  $\text{Cs}_2\text{ZrCl}_6$  NCs with a PLQY up to 60.37% is synthesized.  
Credit: LIU Siping and YANG Bin

In recent years, all-inorganic  $\text{CsPbX}_3$  ( $\text{X} = \text{Cl}, \text{Br}, \text{I}$ ) perovskite nanocrystals have attracted extensive research attention due to their excellent photoelectric properties. However, the problems of Pb toxicity and poor stability hinder their practical application.

A research group led by Prof. Han Keli from the Dalian Institute of

Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) synthesized vacancy ordered  $\text{Cs}_2\text{ZrCl}_{6-x}$  ( $0 \leq x \leq 1.5$ ) double [perovskite nanocrystals](#) (NCs) for the first time via hot injection method.

This study was published in *Angewandte Chemie International Edition* on August 22.

The  $\text{Cs}_2\text{ZrCl}_6$  NCs exhibited long-lived triplet [excited state](#), featuring highly efficient photoluminescence (PL) quantum efficiency due to thermally activated delayed fluorescence.

The scientists also revealed the mechanism of TADF by detailed experimental characterizations including temperature-dependent photoluminescence [spectra](#), temperature-dependent time-resolved photoluminescence spectra, nanosecond transient emission spectra, and pump-probe femtosecond time-resolved spectra.

TADF is promising luminescence mechanism for obtaining high exciton utilization. It is common in solid organic molecules or metal-organic complexes, but rarely reported in all-inorganic colloidal nanocrystals.

The study provides a unique strategy for the development of new inorganic phosphors.

**More information:** Siping Liu et al. Efficient Thermally Activated Delayed Fluorescence from All-Inorganic Cesium Zirconium Halide Perovskite Nanocrystals, *Angewandte Chemie International Edition* (2020). [DOI: 10.1002/anie.202009101](https://doi.org/10.1002/anie.202009101)

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