

Electro photocatalytic degradation of organic pollutants over cerium doped-calcium titanate nano-perovskite.

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Background

Natural disasters, population expansion, and water pollution-related shortages of potable water may cause significant problems for the world in the coming years. The demand for clean water has raised concerns about water treatment technology[3]. The photocatalytic approach of water treatment has accumulated a lot of attention recently. A well-known, ecologically friendly technique called photocatalysis totally transforms contaminants into water and carbon dioxide[1]. In order to aid in the degradation of water contaminants, much effort has been made into designing effective photocatalysts. Perovskite photocatalyst materials have gotten a lot of interest due to their exceptional features and adaptability in the chemical composition, structure, bandgap, oxidation states, and valence states[2].

Problem statement

Fresh, uncontaminated water is necessary for human development and health. Water scarcity and other environmental issues are a result of the growing global population. Researchers have been drawn to the development of affordable technologies for eliminating organic contaminants following traditional treatment. Therefore, the focus of this study is on the application of cerium doping to improve the performance of perovskites.

Aim and objectives

The aim of the current study is to create calcium titanate perovskite systems and analyse their photoelectrochemical and electrochemical capabilities. The material's electro-photocatalytic capabilities will be evaluated using an organic pollutant like methylene blue and rhodamine B.

the objectives of this work are to:

1. Synthesise the calcium titanate (CaTiO_3) perovskite.
2. Synthesise calcium titanate (CaTiO_3) with different ratios of cerium (Ce).
3. Characterisation of the prepared material.
4. Test the electro photocatalytic properties of the material using methylene blue and rhodamine B.

The prepared material will be characterised using various techniques

Results and discussion

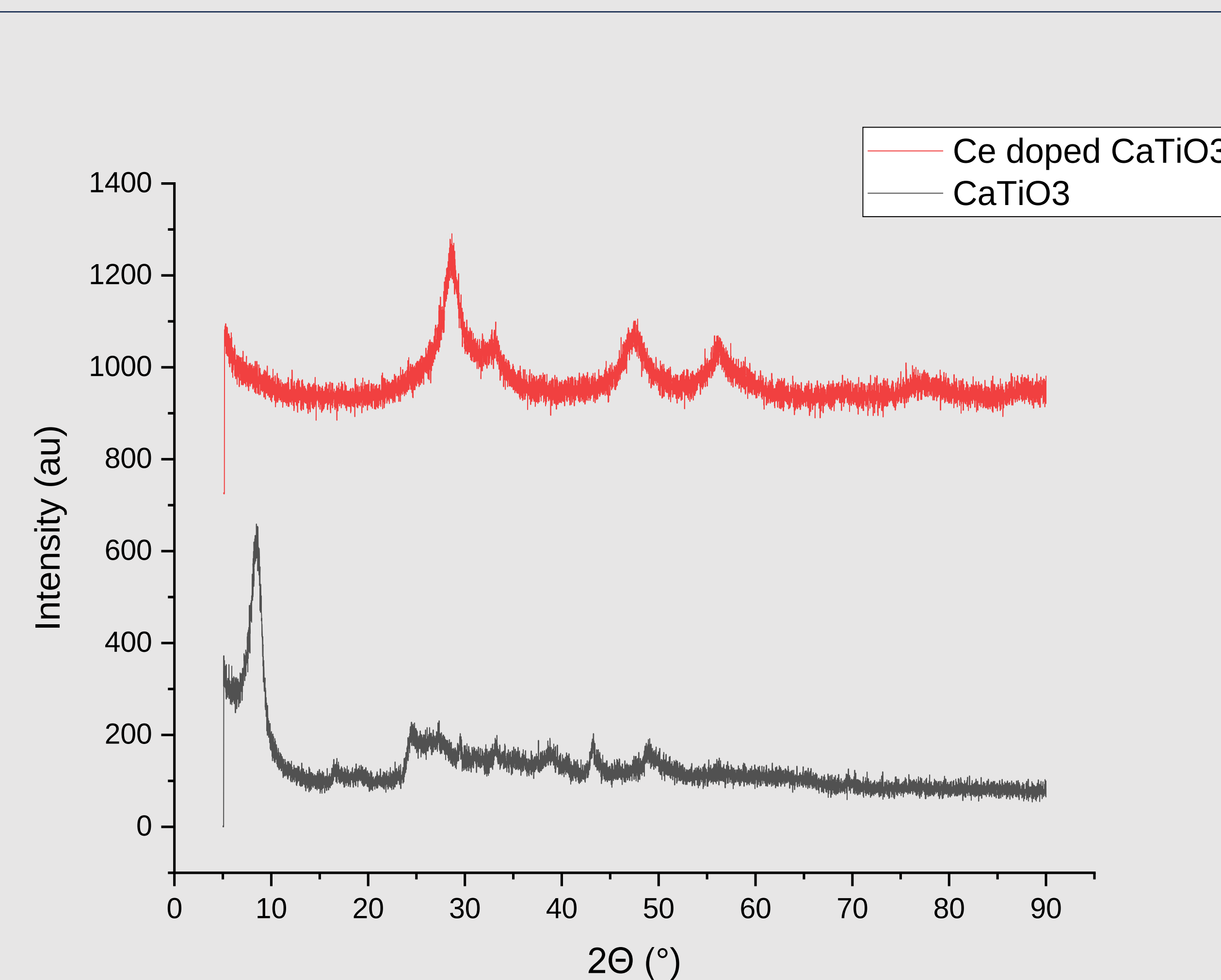


Figure 1: XRD patterns of CaTiO_3 and Ce-doped CaTiO_3

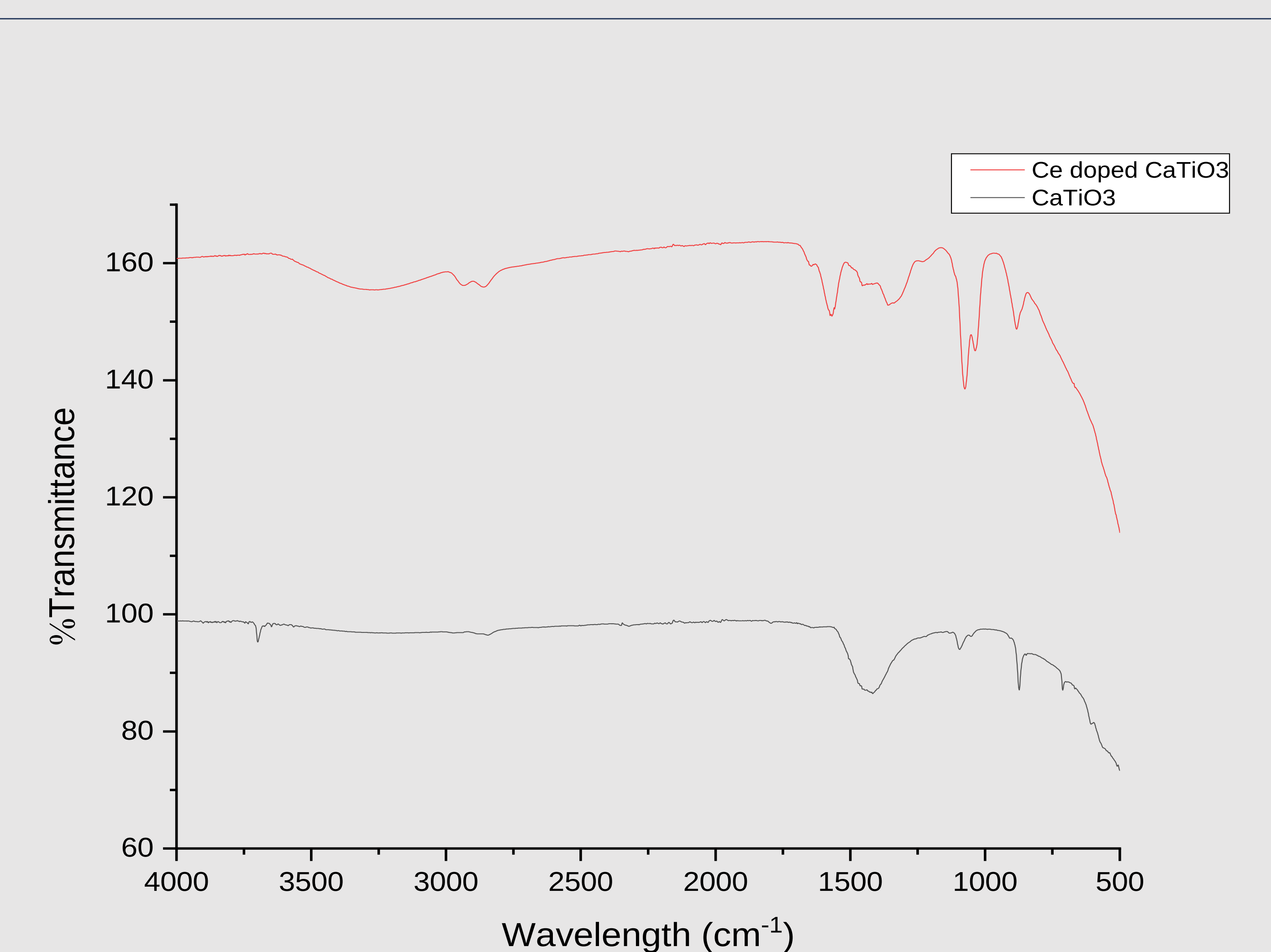


Figure 2: FTIR spectrum of CaTiO_3 and Ce-doped CaTiO_3

Methodology

- Calcium nitrate tetrahydrate and different kinds of titanium precursors were used in the synthesis of CaTiO_3 , KOH was added while stirring and heated to boil.
- The resulting product was isolated by centrifuge before being transferred to vials for hydrothermal treatment and finally filtered before characterisation.
- CaTiO_3 was then doped with cerium

References

1. AJIBOYE, T. O., OYEWO, O. A. & ONWUDIWE, D. C. 2021. Adsorption and photocatalytic removal of rhodamine B from wastewater using carbon-based materials. *FlatChem.*, 29.
2. IRSHAD, M., AIN, Q. T., ZAMAN, M., ASLAM, M. Z., KOUSAR, N., ASIM, M., RAFIQUE, M., SIRAJ, K., TABISH, A. N., USMAN, M., HASSAN FAROOQ, M. U., ASSIRI, M. A. & IMRAN, M. 2022. Photocatalysis and perovskite oxide-based materials: a remedy for a clean and sustainable future. *RSC Adv*, 12, 7009-7039.
3. TAN, Y., WONG, C. & MOHAMED, A. 2011. An overview on the photocatalytic activity of nano-doped- TiO_2 in the degradation of organic pollutants. *ISRN Materials Science*, 2011, 1-18.

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