Molten salt synthesis of calcium manganite based compounds

Dovydas Karoblis, Aleksej Žarkov, Aldona Beganskienė, Aivaras Kareiva

Institute of Chemistry, Vilnius University, Naugarduko 24, LT-03225 Vilnius, Lithuania
**Corresponding author: E-mail: dovydas.karoblis@chgf.vu.lt*

Faculty of Chemistry and Geosciences

Introduction

Thermoelectric materials have the possibility to convert heat to electric power based on Seebeck effect, and electricity to cooling by the Peltier effect. Bismuth telluride (Bi_2Te_3) and its alloys are known as the best thermoelectric materials near room temperature [1], but this compound is expensive and not stable at high temperatures. On the other hand, oxide materials have good chemical and structural stability at high temperatures, are non-toxic and economical [2]. The calcium manganite based $CaO(CaMnO_3)m$ (m = 1, 2, 3) compounds with Ruddlesden-Popper structure are considered as the most prominent thermoelectric materials [3].

Work objective

The main aim of this work was to prepare calcium manganite based $CaO(CaMnO_3)m$ (m = 1, 2, 3) compounds by applying molten salt synthesis. Determining optimal synthesis conditions (temperature, annealing time, ratio between salts and precursors) for preparation of different composition final products was additional task. Investigation of phase-purity as well as morphology of obtained samples was supplementary assignment.

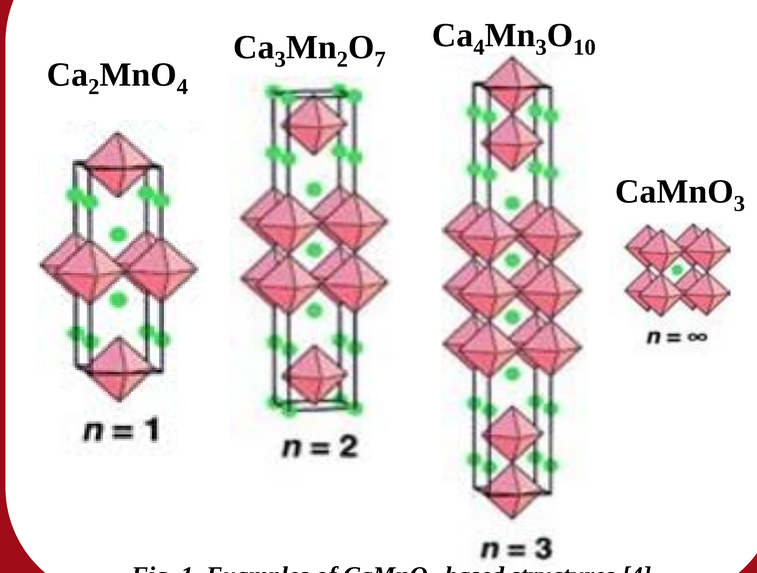

Fig. 1. Examples of $CaMnO_3$-based structures [4].

Results

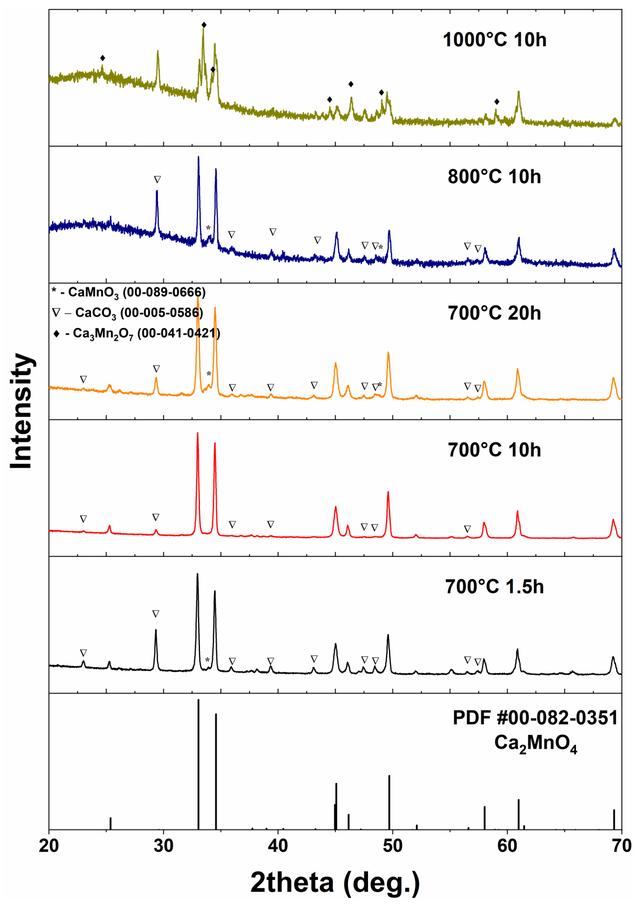

Fig. 2. XRD patterns of Ca_2MnO_4 compounds prepared at different synthesis conditions.

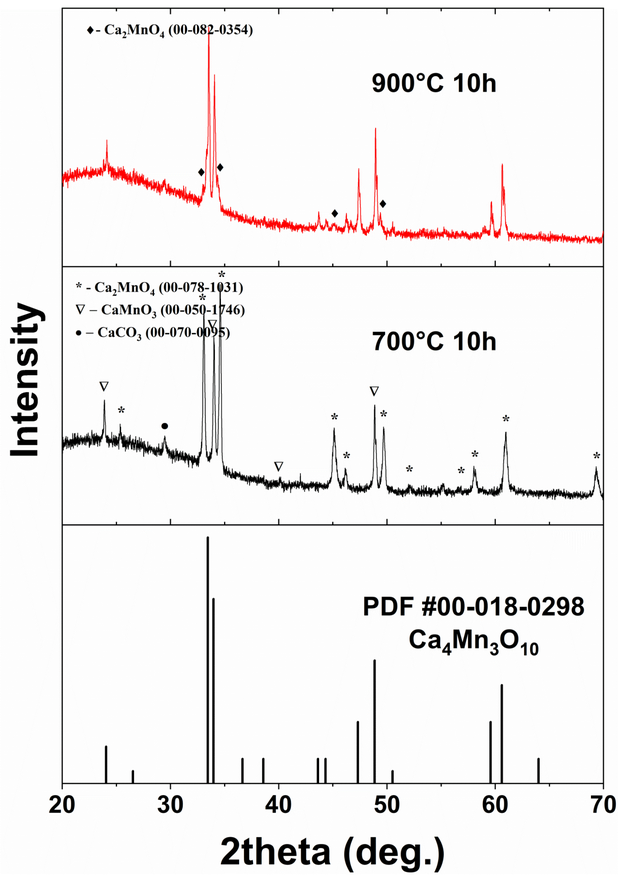

Fig. 3. XRD patterns of $Ca_4Mn_3O_{10}$ compounds prepared at different synthesis conditions.

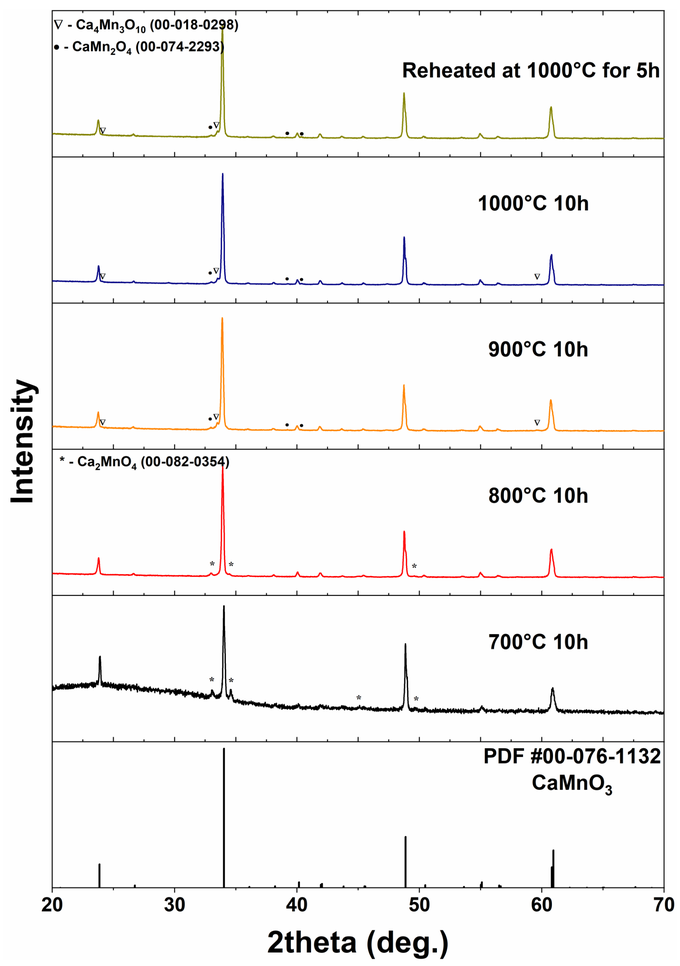

Fig. 4. XRD patterns of $CaMnO_3$ compounds prepared at different synthesis conditions.

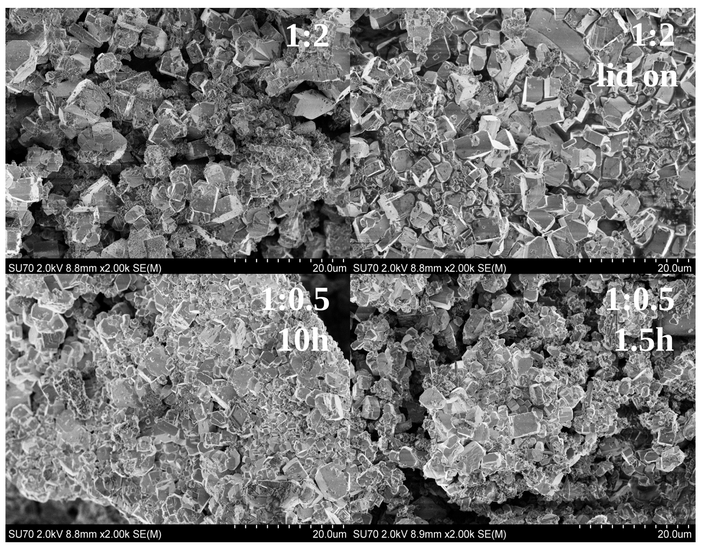

Fig. 5. SEM micrographs of Ca_2MnO_4 compounds annealed at 700 °C with different precursor:salt ratios and times.

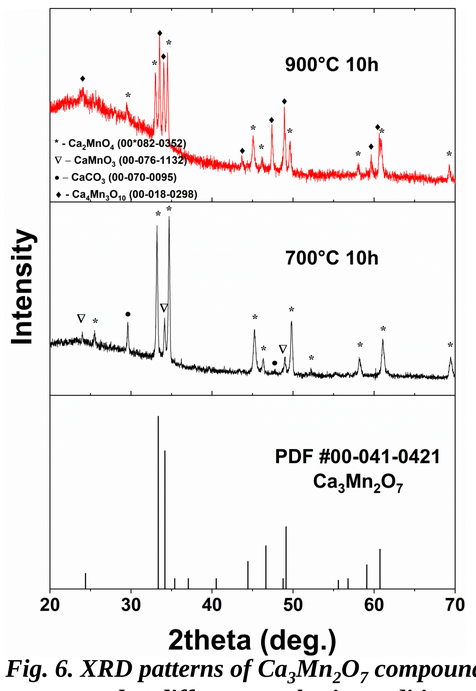

Fig. 6. XRD patterns of $Ca_3Mn_2O_7$ compounds prepared at different synthesis conditions.

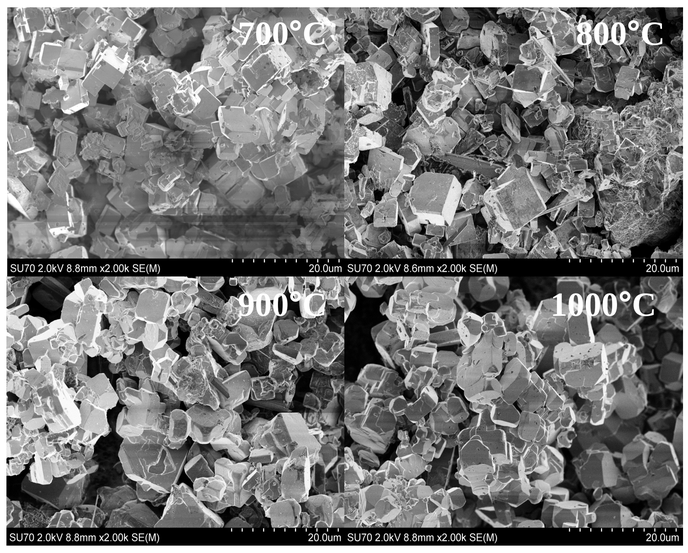

Fig. 7. SEM micrographs of $CaMnO_3$ compounds annealed at different temperatures for 10 h with 1:2 precursor:salt ratio.

References

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Acknowledgements

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