第 725 回　化学・物質工学セミナー開催のお知らせ

下記および別紙の通りセミナーを開催致します。万障お繰り合わせの上，ご参加下さい。オンラインでの配信も行います。

記

日時：　2022 年 8 月 1 日（月）　14:30 ~ 16:00
形式：　対面（事前登録をお願いします。詳細は後述）
場所：　長崎大学文教キャンパス　総合教育研究棟 2 階多目的ホール
講師：　Dr. Martin Ihrig (Forschungzentrum Jülich GmbH)
演題：　Ceramic-Based All Solid-State Li Batteries by Advanced Sintering Techniques

感染対策および事前登録について

感染拡大予防のため，事前登録制といたします。参加登録フォームより登録をお願いします。当日，余裕があれば，直接ご参加いただくことも可能です。

また，学内外の感染状況によっては，ハイブリッドまたは全面オンラインとなる可能性もございます。ご了承ください。現地にてご参加いただく場合は，感染対策にご協力をお願いします。

参加登録フォーム　　https://forms.gle/mhCQ6RF4C4bRaRp87

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Ceramic-Based All Solid-State Li Batteries by Advanced Sintering Techniques

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Abstract

Garnet-based $Li_7La_3Zr_2O_{12}$ (LLZ) all-solid-state Li batteries (ASBs) are considered the next generation of Li batteries. Fabrication of such ASBs requires co-sintering of the cathode active material (CAM) and electrolyte. However, the conventional co-sintering of CAM and LLZ leads to non-conductive side phases as a result of long exposure to high temperatures. Advanced sintering shortens the dwell time and reduces the sintering temperature are required to maintain phase purity.

Such a technique is Field Assisted Sintering Technique/Spark Plasma Sintering. The application of high mechanical pressure allows to lower the sintering temperature and reduce the dwell time to minutes for the fabrication of functional $LiCoCO_2$ (LCO)/LLZ solid-state battery components e.g. dense and thick LCO/LLZ composite cathodes providing a good utilization of LCO and leading to a high areal capacity. A careful optimization of the sintering parameters allows the tailoring of the density and enable polymer infiltration and so called "polymer-ceramic" ASBs

Another technique is Ultrafast High-temperature Sintering (UHS) can sinter bulk sinter-additive-free LLZ pellets within seconds, kinetically inhibiting side reactions. Although the sintering process is short, a mechanically stable, phase pure, and sufficiently dense LLZ with good ionic conductivity is obtained. The introduced UHS process is predestined for co-sintering of LLZ and CAMs, as it could help to overcome thermodynamic limitations and avoid the formation of a diffusion-based secondary phase, which enables CAM/LLZ combinations which were unsuitable so far.

Besides, tape casting is suitable for the preparation of thin LLZ-based separator, a prerequisite to obtain high energy density. Tape casting is besides relevant for other ceramic materials such as $LiFePO_4$ and $Li_{1.5}Al_{0.5}Ti_{1.5}(PO_4)_3$ as these materials can be co-sintered. Assembly into polymer-ceramic full cells shows their promising electrochemical performance and after some conditioning stable cycling.

Keywords: Ceramic Li batteries, FAST/SPS, UHS, tape casting, LLZO, LCO, LATP, LFP

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