IONIC LIQUIDS FOR THE SYNTHESIS OF INORGANIC OXIDE POWDERS AT LOW TEMPERATURE

Ionic liquids offer huge promising opportunities for low-temperature synthesis of new materials. Owing to their tunable characteristics and their influence on the materials properties, they greatly facilitate the synthesis of materials with specific structure and morphology.

<table>
<thead>
<tr>
<th>REFERENCES</th>
<th>IONIC LIQUIDS</th>
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<tbody>
<tr>
<td>Im3008b</td>
<td>1-(3-Hydroxypropyl)-3-Methylimidazolium Bis(trifluoromethanesulfonyl)imide [(pOH)mim] NTf₂</td>
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<tr>
<td>Im0208b</td>
<td>1-Ethyl-3-Methylimidazolium Bis(trifluoromethanesulfonyl)imide [Emim] NTf₂</td>
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**Applications:**

Ionic liquids behave both as solvent and structuring agent leading to the synthesis of complex organic oxide powders with a simple and efficient process in terms of energy and reactants involved.

These materials are used as constituents for the manufacturing of:

- electrode materials,
- ceramics,
- pigments,
- magnetic materials for information storage.

**Synthesis of LiFePO₄ powders for « Lithium-ion » batteries**

Ionic liquids are of a growing interest in the search for new materials especially for energy storage. The results presented by Recham et al. showed the advantages of using ionic liquids as solvents for the synthesis of LiFePO₄¹ and LiFeSO₄F².

**Reaction in ionic liquid environment**

1. \( \text{FeC}_2\text{O}_4 \cdot 2\text{H}_2\text{O} + \text{LiH}_2\text{PO}_4 \xrightarrow{\text{ou}} \text{LiFePO}_4 \)

\[
\begin{align*}
[a] & \quad ([\text{pOH}]\text{mim}] \text{NTf}_2 \\
& \quad 200^\circ\text{C} \quad 24\text{h}
\end{align*}
\]

2. \( \text{FeSO}_4 \cdot \text{H}_2\text{O} + \text{LiF} \xrightarrow{\text{[Emim]} \text{NTf}_2} \text{LiFeSO}_4\text{F} \)

\[
\begin{align*}
[b] & \quad ([\text{Emim}] \text{NTf}_2 \\
& \quad 250^\circ\text{C} \quad 24\text{h}
\end{align*}
\]

**Advantages of the process:**

- Reaction at atmospheric pressure and low temperature
- Classical extraction: centrifugation or by solvent
- Recycling: recovery or reuse of Ionic Liquids
- Homogeneous material and controlled morphology => Electrochemical performance optimized
- Oxidation phenomenon eliminated

¹ N. Recham et al., Chem. Mater., 2009, 21 (6), pp 1096–1107