


Chapter 3


Synthesis, Characterizations, and Applications of Ionanofluids

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ABSTRACT

Ionic liquids (ILs) are a class of versatile, non-volatile, and thermally stable substances that have garnered significant attention for their potential applications in green chemistry, catalysis, and material science. This chapter explores the synthesis,

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properties, and diverse applications of ILs, with a focus on their role as sustainable solvents. Their unique ionic composition enables adjustable properties such as viscosity, hydrophobicity, and thermal stability, making them ideal for advanced industrial processes, including energy storage, environmental remediation, and catalysis. Emerging research into task-specific ILs and ionic liquids, combining ILs with nanomaterials, reveals their transformative potential in enhancing thermal conductivity, reaction selectivity, and environmental compatibility. Challenges like toxicity and production costs are also addressed, highlighting future directions in designing safer and more efficient ILs to meet industrial and environmental demands.

INTRODUCTION

The increased use of ionic liquids in various field of chemistry and engineering sciences is closely connected with their characteristics and possibilities of their utilization. These fluids are non-volatile and thermally stable due to ionic nature of these fluids. Their special characteristics enable a wide range of uses. One of the latest developments in this field is the creation of ionic liquids. These materials combine ionic liquids with nano-materials, forming a dispersion of nanoparticles. This combination results into improved performance in several areas of usage. Containing ions, these nano-fluids are particularly useful in heat transfer applications, and therefore in cooling. They also have uses in catalysis, the speeding of chemical reactions by reaction facilitators.

Also, ionic liquids can be employed in solar absorbing surfaces where convection of heat is effective in capturing the sun's energy. They also act as superior emulsifiers and absorb excess moisture that causes wear in the machinery. Other interesting field is in the luminous materials where they participate in operation of lights and displays.

Research on ionic liquids is growing, with many recent studies published in physical and chemical journals. These papers explore the effectiveness and potential of these new materials. With increased discovery, ionic liquids together with their nano-material composites may find potential application across different sectors.

Ionic liquids have been defined as salts with melting point of not more than 100 °C. In some form it also assists in the classification of such substances based on their physical characteristics. However, the term ionic liquid carries different connotations for different persons. Some may also confine it to include other parts or blends or any other preparation. Others may find interest in one of more properties of the substance like ionic conductivity, or solubility, etc. This variation in understanding can create confusion when speaking of ionic liquids in scientific or industrial setting. As such, the freedom definition entails that the key feature should

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