

## **Ionic Liquid**

### **FUJI IL Series**

Ionic Liquid is the new material that has been intensively under research and development, and commercialization. Recently, ionic liquid is defined as the material (salt : composed of 100 % of ion) that they exist as the “liquid” under 100°C. One can create numerous numbers of material, and properties by combining various kinds of cation and anion. Therefore, they can be regarded as designer’s solvent. Or sometimes even referred as “the third liquid” following to water and organic solvent.

#### **The feature of ionic liquid**

1. They stay as the liquid under wide temperature range so that they can be applied and utilized under high and low temperature.
2. Ionic liquid is conductive so that they can be used for electrochemical devises and antistatic purpose.
3. Ionic liquid is chemically, electrochemically stable, also safe under high temperature. Therefore, they can be used under various kinds of extreme conditions.
4. Ionic liquid can be used under vacuum condition because vapor pressure of ionic liquid is low.
5. Ionic liquid is very safe material because they possess flame retardant property.
6. Ionic liquid can dissolve (melt) various kinds of material including cellulose so that numbers of application can be expected.

## Chemical Composition

Ionic liquids are composed of organic cation such as imidazolium ion, pyridinium ion etc... and anion including bromide, fluoride, chloride etc... and form as the liquid under relatively low temperature even they are 100 % ion material.

## Example of Ionic Liquid

### Cation

1- ethyl-3-methylimidazolium (EMI)  
1- butyl-3-methylimidazolium (BMI)  
N,N –dialkylpyrrolidinium  
1,3- dialkylimidazolium  
N-dialkylimidazolium  
tetraalkylammonium

### Anion

Hexafluorophosphate  $PF_6^-$   
Tetrafluoroborate  $BF_4^-$   
 $NO_3^-$   
Hydrofluoride anion  $F^-$  (HF)  
2,3-Trifluoromethanesulfonate  $CF_3SO_3^-$   
Fluorine containing anion  $F(HN)_n^-$

And so many other combination.

## Application of Ionic Liquid

### 1. antistatic material

By adding and mixing into resin, ionic liquid can be used as antistatic material. Because ionic liquid is non-volatile and possess high heat resistance, they can be mixed into resin under high temperature process. By optimizing ionic liquid structure and compatibility with resin, they can be excellent antistatic material while maintaining the transparency. They are also known as the material not to be much

effected by outside condition such as humidity. They also have high tolerance against high temperature and can be mixed into resin such as polycarbonate. Ionic liquid is also expected to be good antistatic materials for paints for building, UV hard coating material, adhesive materials and so on.

## **2. Electrolyte**

The property necessary for the electrolyte, is to possess high conductivity, high voltage tolerance, large capacity, high tolerance against low and high temperature, safety and so on. Ionic liquid has high potential in this regard and they can be expected to be used for various types of electrochemical devices such as electric double layer capacitor (EDLC), lithium ion battery (LIB), dye sensitized solar cell (DSC), and fuel cell etc...

## **3. Solvent for synthesis**

Recently in the chemical industry area, it is urgent to develop green process such as to replace strong smelly organic solvent with other environmentally friendly liquid for the reactive synthesis solvent. Ionic liquid has high expectation in this area too. Because ionic liquid can be readily used repeatedly by separating other liquid by heating, distilling and so on. Therefore it can be recyclable and environmentally friendly.

## **4. Solvent which can dissolve (melt) non soluble material like cellulose**

Ionic liquid can dissolve (melt) non soluble material such as cellulose. When cellulose is regenerated, polymerization degree is maintained so that essential property of cellulose would not be changed. This

properties has the possibility to be utilized to make fiber, sheet of recycle cellulose.

## 5. CO<sub>2</sub> Absorbance

Carbon dioxide is one of the major reason for global warming problem. Since the ionic liquid is non-volatile and do not spread into gas phase, they have possibility to be used for absorbing CO<sub>2</sub> separation and recovering process from industrial waste gas.

## 6. Lubricant

Lubricant is widely used for various type of machineries in order to mainly to decrease the friction between substances so that energy efficiency can be enhanced. In this respect, ionic liquid has high expectation because their boiling temperature is extremely high so they can be applied for lubricant even under vacuum condition.

Product Name	Structure	CAS	Solubility	melting point	specific gravity
1-Butyl 3-methyl imidazolium chloride	C8H15CIN2	79917-90-1	hydrophilic	70 C°	1.086 g /cm <sup>-3</sup>
1-Butyl-2,3-dimethylimidazolium chloride	C9H17CIN2	98892-75-2	hydrophilic	89 C°	
1-Butyl 3-methyl imidazolium Bromide	C8H15BrN2	85100-77-2	hydrophilic	72 C°	1.084 g /cm <sup>-3</sup>
1-Butyl 1-methyl pyrrolidinium Chloride	C9H20CIN	479500-35-1	hydrophilic		

We have synthesized above ionic liquid so far and numbers of other ionic liquids are under intensive development. We can synthesize most of the ionic liquid as customer request so that please consult with us including technical detail anytime.