

液体エレクトレット材料の性能と分子構造の相関

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Correlation Between Function and Molecular Structure of Liquid Electrets (¹*Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS)*,
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Molecules characterized by a π -conjugated structure at their core, surrounded by flexible yet voluminous branched alkyl chains, have garnered significant interest as π -based molecular soft materials. These compounds can exist as solvent-free, room-temperature liquids, so-called alkyl- π liquids, while maintaining the optical and electronic properties intrinsic to π -conjugated molecules. Our research revealed that subjecting this alkyl- π liquid to a corona charging treatment facilitates the creation of a liquid electret capable of stably retaining electrostatic charges within the liquid. Specifically, we have developed liquid electrets, including alkyl-porphyrin liquids¹⁾, -fullerene liquids²⁾, -pyrene liquids³⁾, and alkyl-conjugated polymer liquids⁴⁾. A notable characteristic of these liquid electrets is that an increased capacity for electrostatic charge retention within the liquid and an extended duration of charge retention correlate positively with their efficacy as devices for vibration power generation. In this presentation, we shall elucidate the correlation between the electronic structure parameters of π -conjugated units and the amount of stored charge, along with their potential applications as stretchable micro-vibration sensors.

Keywords : *Functional Molecular Liquids; Electrets; Structure-Property Relationship; π -Conjugated Molecules*

π 共役分子を分子中心に配置し、柔軟で嵩高い分岐アルキル鎖で被覆した分子は、 π 共役分子固有の光・電子機能を保持した常温液体（アルキル- π 液体）として得ることができる π 系分子ソフト材料として注目を集めています。このアルキル- π 液体をコロナ帯電処理することで静電荷を液体内に保持した液体エレクトレットを創成可能なこと我々は見出しました。具体的には、アルキル-ポルフィリン液体¹⁾、-フラーレン液体²⁾、-ピレン液体³⁾に加え、アルキル-共役高分子液体⁴⁾において、液体エレクトレットを創成しました。液体内に保持する静電荷量が多く、電荷保持時間が長いほど、振動発電素子としての性能も高くなります。講演では、 π 共役分子の電子構造パラメータと帯電量の相関に加え、伸縮性微弱振動センサとしての可能性に関して紹介する。

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