フェニルシラン誘導体を含むイオン液体を用いた室温でのグラファイト炭素膜の新陽極電着プロセス

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New anodic electrodeposition process of graphite carbon films at room temperature using ionic liquid containing phenylsilane derivatives ([1]*Department of Applied Chemistry, School of Engineering, Tohoku University*, [2]*Fukushima Renewable Energy Institute, Advanced Industrial Science and Technology* (*FREA*), [3]*Department of Pure and Applied Chemistry, Faculty of Science and Technology, Tokyo University of Science*) ○Nana Hozuki,[1,2] Hidetaka Takato,[2] Shingo Maruyama[1], Michio Kondo,[2] Kenjiro Fujimoto,[3] Yuji Matsumoto[1]

Graphite carbon films have a variety of industrial applications, such as an anode material for lithium-ion batteries. However, the deposition of graphite carbon films requires a high process temperature, far above room temperature. In this study, we propose a new anodic electrodeposition process at room temperature using ionic liquids (ILs) containing phenylsilane derivatives, where three types of phenylsilane derivatives (DMPh-Si, MDPh-Si, and TriPh-Si) were added to ILs, respectively.[1] The room temperature electrodeposition was conducted within the potential window of the ILs. As shown in the SEM images in Figure 1, high quality graphite carbon films were successfully deposited on the Pt anode for all the derivatives. In addition, Raman spectroscopy revealed that the graphite structure of the electrodeposited film differs depending on the type of phenylsilane derivative added to ILs. One of the features of this process is that it can be deposited at room temperature, and in contrast to conventional electrodeposition processes, the electrodeposition is carried out directly onto the anode electrode through oxidation of the carbon sources. The compound dependence of the phenylsilane derivatives will be discussed in the presentation.
Keywords : Carbon films, electrodeposition, ionic liquid, phenylsilane derivatives

グラファイト炭素膜はリチウムイオン電池の負極材など工業的に多様な用途がある。しかし、その成膜には室温を遥かに超える高いプロセス温度が必要であるという課題があった。そこで、本研究ではフェニルシラン誘導体含有のイオン液体（IL）を用いた室温での新陽極電着プロセスを提案する[1]。3 種類のフェニルシラン誘導体（DMPh-Si、MDPh-Si、TriPh-Si）をそれぞれ加えた IL を用いて IL の電位窓内で室温電着を試みたところ、図 1 の SEM 像に示すようにいずれの誘導体でも高品質なグラファイト炭素膜が Pt 陽極上に堆積していることが観察された。また、ラマン分光測定から、IL に加えるフェニルシラン誘導体の種類ごとに、得られる電着膜のグラファイト構造が異なることがわかった。本プロセスの特徴として室温で成膜可能な点にくわえ、従来の電着プロセスと対照的に炭素源酸化による陽極上への電着である点が挙げられる。当日の講演ではフェニルシラン誘導体の化合物依存性についても議論する。

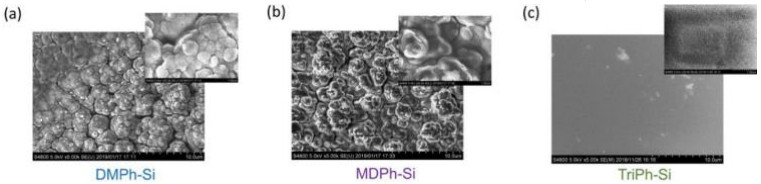

Figure.1 SEM images of electrodeposited films from ILs with phenylsilane derivatives, (a) DMPh-Si, (b) MDPh-Si and (c) TriPh-Si, respectively.

[1] N. Hozuki *et al.*, *Chem. Lett.* **2020**, 49, 1349–1352.