# Quantitative $CO_2$ Solubility Determination in Electrolytes by Fourier-Transform Infrared Spectroscopy

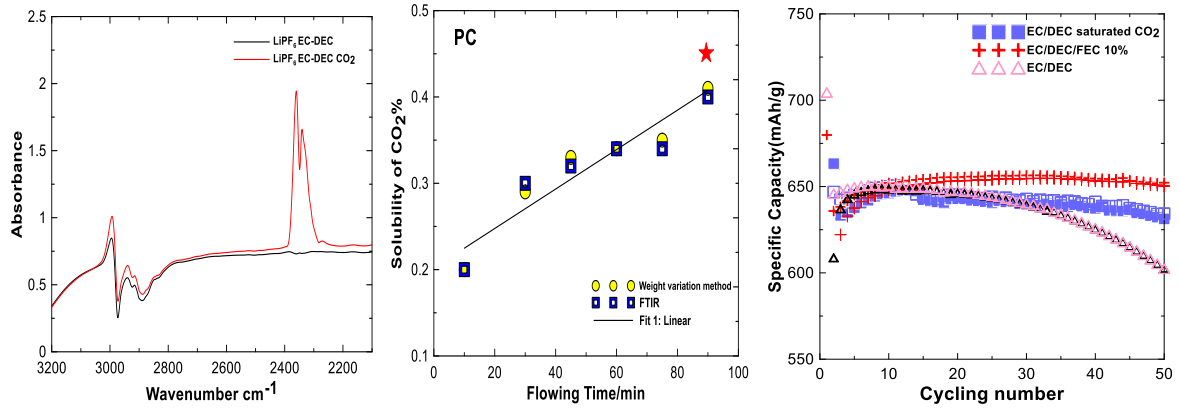
Haonan Yu [a] and M.N. Obrovac[a,b]
[a] *Department of Chemistry, Dalhousie University, Halifax, N.S. Canada*
[b] *Department of Physics and Atmospheric Science, Dalhousie University, Halifax, N. S., Canada*

E-mail: hn420233@dal.ca

$CO_2$ is an excellent electrolyte additive for lithium batteries containing Si alloy negative electrodes.[1] Its efficacy in increasing cycle life is directly related to the amount dissolved in the electrolyte. Therefore determining the solubility of $CO_2$ in electrolytes and identifying which electrolytes have the greatest $CO_2$ solubility is essential. Although the $CO_2$ content in electrolytes may be accurately determined by mass, this measurement is difficult to do, especially in small quantities.

Here the solubility of $CO_2$ in different electrolytes was determined by FTIR spectroscopy. It was found that FTIR absorption with respect to a standard can be used to easily and accurately determine $CO_2$ content. The FTIR spectrum of an electrolyte with and without $CO_2$ is shown below. There are two sharp peaks at ~2350cm$^{-1}$ in the electrolyte containing $CO_2$ that are not present in the electrolyte containing no $CO_2$. These peaks were used as a means of quantitative $CO_2$ determination.

The $CO_2$ content in pure PC during bubbling with flowing $CO_2$ measured by FTIR and by weight versus the $CO_2$ flowing time is also shown below. The results from two techniques are consistent. The cycling performance of Si alloy in electrolyte with and without $CO_2$ is shown below. Electrolytes with high $CO_2$ content result in significantly more stable cycle life.




**References:**

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