

# TetGal

## Tetrakis(perfluororganyl)gallate for LIBs, ILs and photocatalysis

### Invention

Scientists at the University of Bielefeld successfully synthesized tetrakis(perfluoralkyl)gallate, tetrakis(perfluoralkenyl)gallate, and tetrakis(perfluoralkinyl)gallate, e.g. as the conducting salt for lithium-ion batteries, as a photoacid generator or as a weakly coordinating anion in ionic liquids.

### Commercial Opportunities

The lithium salt of tetrakis(pentafluoroethyl)gallate,  $\text{Li}[\text{Ga}(\text{C}_2\text{F}_5)_4]$ , has been successfully tested as a conducting salt, for instance in lithium-ion batteries. A coulombic efficiency only slightly below the reference cell with  $\text{Li}[\text{PF}_6]$  could already be determined on the as yet unoptimized system. The conductivity of  $\text{Li}[\text{Ga}(\text{C}_2\text{F}_5)_4]$  in a 1 M diethyl carbonate solution, which is twice as high compared to  $\text{Li}[\text{PF}_6]$ , and its thermal stability (greater than  $150^\circ\text{C}$ ) were demonstrated in the laboratory.

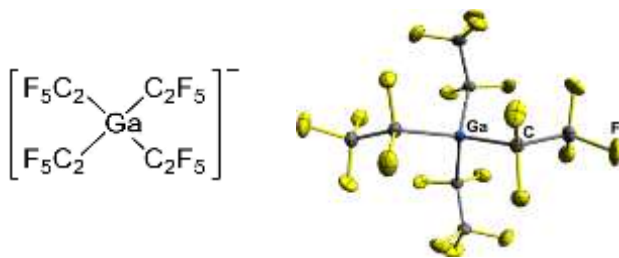


Figure 1: Molecular structure of the anion  $[\text{Ga}(\text{C}_2\text{F}_5)_4]^-$  in the solid state

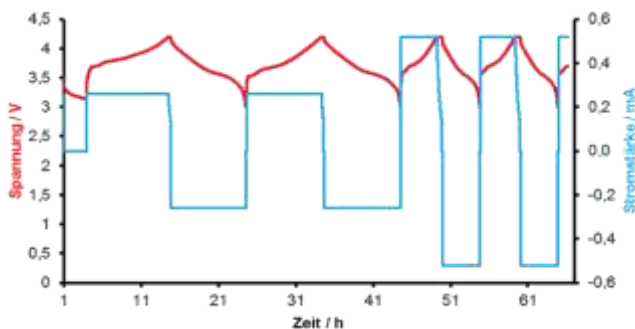


Figure 2: Voltage (red) and current profile (blue) of a prototype battery with  $\text{Li}[\text{Ga}(\text{C}_2\text{F}_5)_4]$  as the conducting salt

### Current Status

A patent has been filed for the invention in Germany. International patent registrations are possible.

### Relevant Publications

Synthesis, Properties and Application of Tetrakis(pentafluoroethyl)gallate,  $[\text{Ga}(\text{C}_2\text{F}_5)_4]^-$ ; M. Niemann, B. Neumann, H.-G. Stammler, B. Hoge, *Angew. Chem. Int. Ed.* 2019, 58, 8938. DOI 10.1002/anie.201904197.

Synthesis and Reactivity of Tris(pentafluoroethyl)gallium Compounds; M. Niemann, B. Neumann, H.-G. Stammler, B. Hoge, *Eur. J. Inorg. Chem.* 2019, 30, 3462. DOI 10.1002/ejic.201900486.

An invention of the Bielefeld University.

### Competitive Advantages

- Non-toxic
- Hydrolytically stable
- High conductivity
- Coulombic efficiency comparable to  $\text{Li}[\text{PF}_6]$

### Technology Readiness Level

1 2 3 4 5 6 7 8

Experimental proof of concept

### Industries

- Battery Industry
- Chemical Industry
- Process Engineering

### Ref. No.

5517

### Contact

Dr. Thorsten Schaefer  
E-Mail: [ts@provendis.info](mailto:ts@provendis.info)  
Phone: +49(0)208-94105-27

