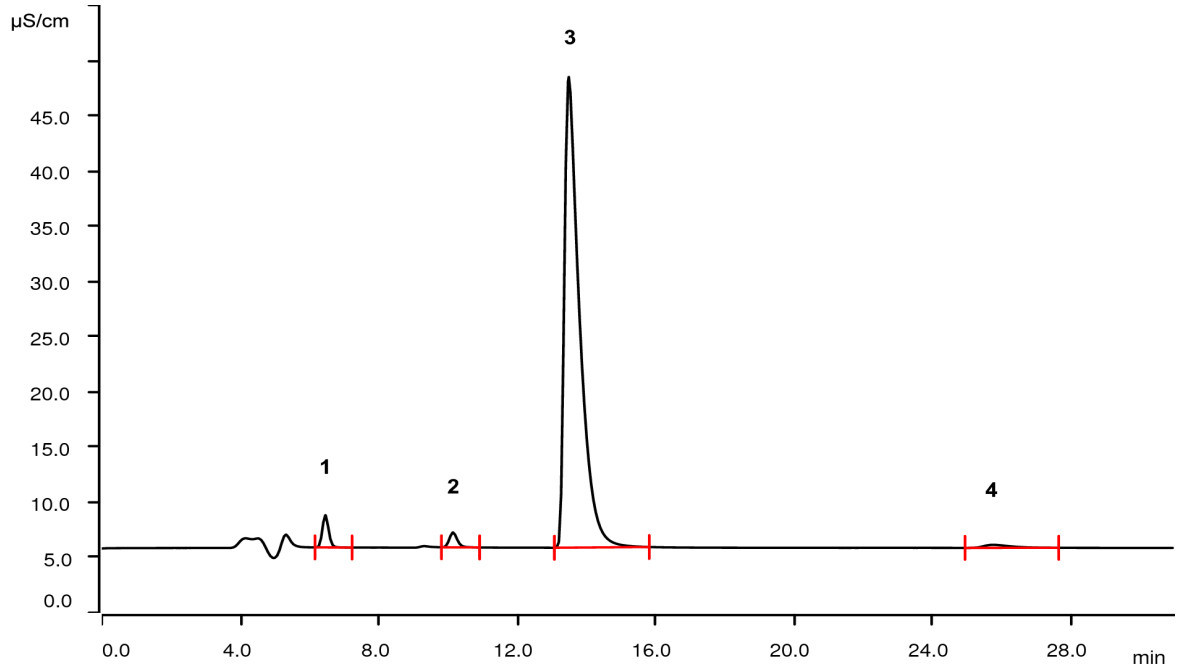
IC Application Note S–372

Hexafluorophosphate and its decay products in battery electrolyte



Lithium ion batteries are rechargeable batteries that are commonly used in portable electronics. The lithium ion is responsible for charging and discharging of these batteries. Organic electrolytes are used in which lithium may be added as $LiPF_6$. Over time, the hexafluorophosphate degrades partially and other phosphates may be found. These phosphates are separated on a Metrosep A Supp 5 - 250/4.0 column and detected applying conductivity detection after sequential suppression.

Results

	Anion	Concentration [%]
1	Difluorophosphate (PO_2F_2)	0.24
2	Difluoro(oxalato)borate ($BF_2(C_2O_4)$)	0.27
3	Hexafluorophosphate (PF_6)	12.1
4	Di(fluorosulfonyl)imide ($N(FSO_2)_2$)	0.31

Metrohm

Sample

Used battery electrolyte

Sample preparation

0.4 g of electrolyte is dissolved with ultrapure water to 100 mL. Direct injection after thorough mixing.

Columns

Metrosep A Supp 5 - 250/4.0	6.1006.530
Metrosep A Supp 5 Guard/4.0	6.1006.500

Solutions

Eluent	14.0 mmol/L sodium carbonate 40% acetonitrile
Regenerant	100 mmol/L phosphoric acid
Rinsing	Ultrapure water

Instrumentation

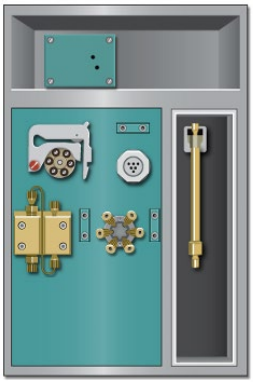
940 Professional IC Vario ONE/SeS/PP	2.940.1500
IC Conductivity Detector	2.850.9010
858 Professional Sample Processor	2.858.0020
MSM-HC Rotor A	6.2832.000

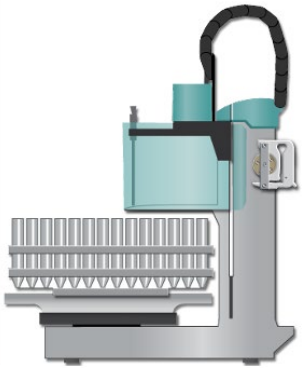
Analysis

Conductivity detection after sequential suppression

Parameters

Flow rate	0.6 mL/min
Injection volume	20 µL
P_{max}	15 MPa
Run time	30 min
Column temperature	25 °C





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