

BATT1025: Accuracy improvement of Fe/P molar ratio analysis in LiFePO_4 cathode material

Introduction

The quality of LiFePO_4 cathode material is closely related to battery capacity, life, and safety. In particular, the molar ratio of the main component, Fe/P, is an indispensable factor for the formation of an ideal crystal structure. Even a small deviation in composition can cause performance variation and degradation. In standardless FP analysis, more accurate analysis results can be obtained by registering a sample that is similar to the analyzed sample as a standard sample in the matching library.

Elemental analysis

- **Analysis:** Processed materials
- **Use:** Quality assurance
- **Analyzed materials:** LiFePO_4
- **Analysis method:** Standardless FP analysis method

		Sample A		Sample B	Sample C
	Stoichiometric value	SQX result (w/o matching)	SQX result (matching)	SQX result (matching)	SQX result (matching)
Fe (mass%)	35.40	37.26	35.37	34.01	34.91
Theoretical Std Dev (mass%)		0.03	0.03	0.03	0.03
P (mass%)	19.64	18.56	19.62	19.64	19.81
Theoretical Std Dev (mass%)		0.02	0.02	0.02	0.02
Fe/P (mol ratio)	1.00	1.11	1.00	0.96	0.98

Table 1: MSQX analysis results of Fe and P, theoretical standard deviation and molar ratio of Fe/P

Conclusion

Matching library registration was performed by using sample A (LiFePO_4 reagent) as the standard sample. The molar ratio of Fe/P was calculated as 1.00. Slight deviations from 1.00 were observed in the molar ratio of Fe/P in the analysis results of Samples B and C, which are battery grade electrode materials. The theoretical standard deviation, which is an indication of analytical error, was about 0.03 mass% for both Fe and P, indicating that the difference between the analysis results of samples B and C and their stoichiometric values is significant. The results show that even with the standardless FP method, the analysis reliability can be improved and small differences in composition can be detected quantitatively.

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