RBS / NRA / PIXE depth profile of LIB positive electrode

As for the analysis of highly-active materials, such as charged-state lithium ion battery (LIB) electrodes, it is necessary to reduce the change of properties during the measurement. With ion scattering analysis, as typified by RBS, composition depth profile can be obtained without using ion etching, which may cause sample degradation. Here, we show the example of compositional depth profile of LIB positive electrode, applying RBS / NRA / PIXE analysis.
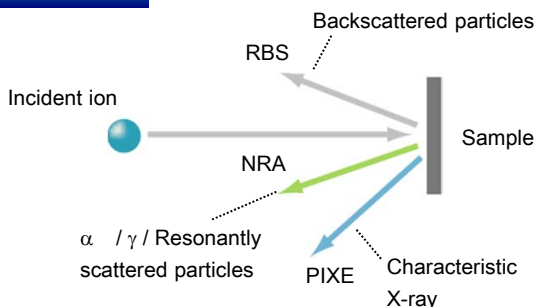
Sample

○Sample

LIB positive electrode : $LiNiMnCoO_x$

Principle

RBS : Rutherford Backscattering Spectrometry
- Accurate composition depth profile

NRA : Nuclear Reaction Analysis
- Li quantification
  Li information depth : ~ 30 μm
- Enhance O sensitivity
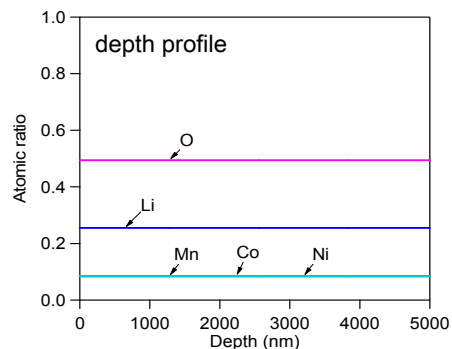
PIXE : Particle Induced X-ray Emission
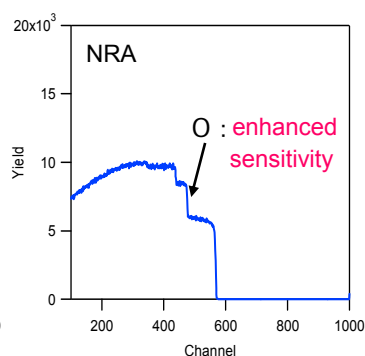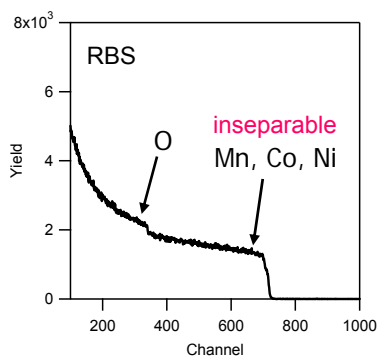- Separate adjacent, heavy elements
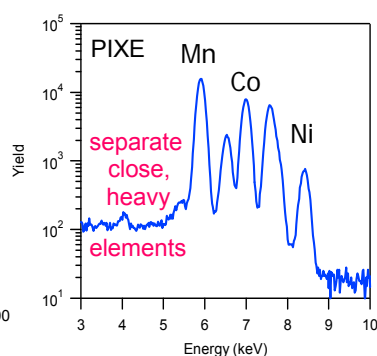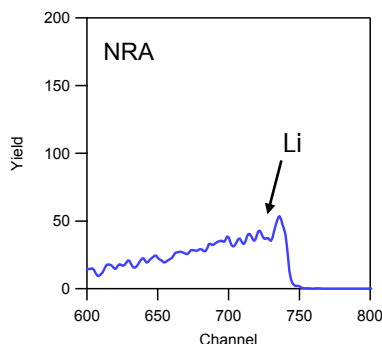
RBS / NRA / PIXE :
Depth profile without using ion etching
- Reduce sample degradation against highly-active materials

$LiNiMnCoO_x$ Depth Profile

RBS: O — inseparable Mn, Co, Ni

NRA: O : enhanced sensitivity

NRA: Li

PIXE: Mn, Co, Ni — separate close, heavy elements

depth profile: O, Li, Mn, Co, Ni

Atomic ratio（normalized by Li content）

Li	Mn	Co	Ni	O
1	0.33	0.33	0.33	1.94

・ Accurate composition, including Li, O

・ Analysis without air exposure

・ Information depth of Li : ～30 μm