<Background>
- Increasing demand for environmentally-benign electric vehicles (EVs)
- Current EVs with limited driving distance (ca. 100 km / charging) due to insufficient energy of batteries, even with best lithium ion batteries (LIBs)
- Innovative batteries with high energy density (5 times of LIBs’ required)

<Establishment of RISING project>
RISING (Research and Development Initiative for Scientific Innovation of New Generation Batteries) Project founded in Kyoto University in 2009 under support of New Energy and Industrial Technology Development Organization (NEDO) Japan

<Project target>
1. Development of technology to realize innovative batteries with its performance much superior to LIBs
2. Establishment of novel analytical methods with society-academia collaboration to understand and improve LIBs
3. Formation of interdisciplinary community for battery development

RISING kick-off meeting (Oct. 2009)

<Technical Focus>
- Observing through different space and time ranges
- Understanding LIB limitations to give new concepts for innovative batteries

Reaction space size (required space resolution)

<table>
<thead>
<tr>
<th>1nm</th>
<th>100mm</th>
<th>10mm</th>
<th>100nm</th>
<th>10nm</th>
<th>1nm</th>
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<tbody>
<tr>
<td>Composite electrode</td>
<td>Secondary particle</td>
<td>Primary particle</td>
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*Electrolyte concentration gradient
*Inhomogeneous reaction sites
*Material shape change
*Conductive agent distribution

<Prospects>

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<tbody>
<tr>
<td>1. Development of advanced analysis</td>
<td>Development of hardware facilities and method</td>
<td>R&amp;D Outputs</td>
<td>Facilities optimization and multi-functional analysis establishment</td>
<td>R&amp;D Outputs</td>
<td>R&amp;D Outputs</td>
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<tr>
<td>Elucidation of LIB reactions</td>
<td>Reaction mechanism elucidation</td>
<td>Degradation mechanism elucidation</td>
<td>LIB material innovation</td>
<td>Guidelines to LIB material innovation</td>
<td>Innovation</td>
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<td>Basic research for post LIBs</td>
<td>Development of Innovative Batteries (Post-LIB) and its evaluation</td>
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</tbody>
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<Summary>
- Fundamental R&D activities needed for realizing batteries for vehicles
- Understanding limitation of current LIB technology with advanced analysis
- Fact-based new concept for realizing innovative batteries performing much superior to LIBs