6 Advanced Science Research

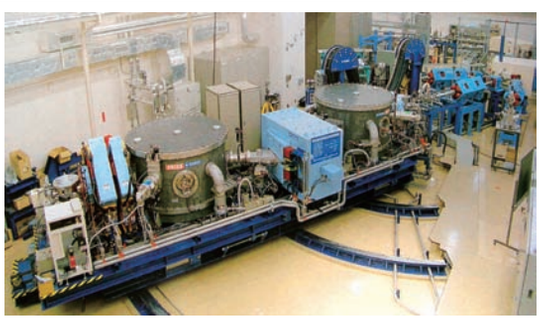
Advanced Basic Research to Create the Future

In the Advanced Science Research Center, new frontier research of nuclear energy and ionizing radiation expected to bear fruit in the future is conducted to discover new principles and phenomena, and furthermore to create new materials and technologies. In order to achieve these aims, we have four basic policies; (1) to pursue research for which the high level research capability (researchers and facilities) in JAEA is effectively used and which is difficult to do in other research organizations, (2) to achieve results before the rest of the world does, (3) to nurture a new basic research area until it becomes fruitful, (4) to explain and apply the research, thus fulfilling our responsibility to society, in conformity with the Third Science and Technology Basic Plan.

The following research is going on: nuclear physics and nuclear chemistry of superheavy elements, the nuclear shell structure, reaction dynamics and electrochemistry using heavy-ion beams of accelerators; synthesis of uranium and transuranium compounds and measurement of their macroscopic quantities and electronic structure, clarification of magnetic structure, magnetic excitation, and the mechanism of superconductivity using NMR, μSR, neutron scattering, and theoretical methods; design of novel materials using mega-gravitation and nano-particle deposition, topmost surface studies using bright and coherent positron beams; elucidation of the interaction mechanism of heavy elements and ionizing radiation within living cells by spectroscopy, and studying the primary and fundamental processes in the interactions of ionizing radiation with matter.

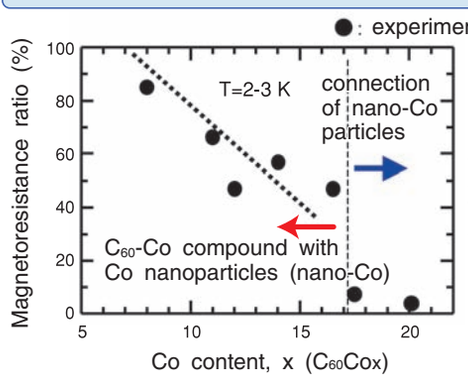
In order to promote this research, we are collaborating with other research sections in JAEA, and several international collaborations are ongoing. In addition, we accept new research subjects based on public suggestions within the framework of the Reimei Research Promotion project of JAEA.

Superheavy Element Nuclear Science



Recoil mass separator for experimental research on fusion reaction mechanisms to produce super-heavy elements by bombarding deformed nuclei with heavy-ion beams from JAEA tandem-booster accelerator.

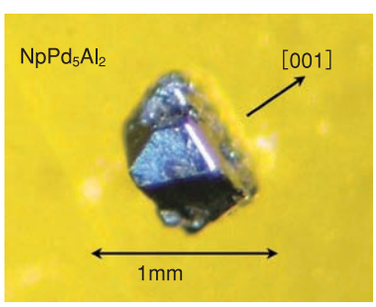
Extreme Environment and Substance Science



Research of new hybrid materials of organic molecules and transition metals for highly functional spintronics.

Finding of anomalously large tunnel magnetoresistance effect (~90%) not predicted by existing theory

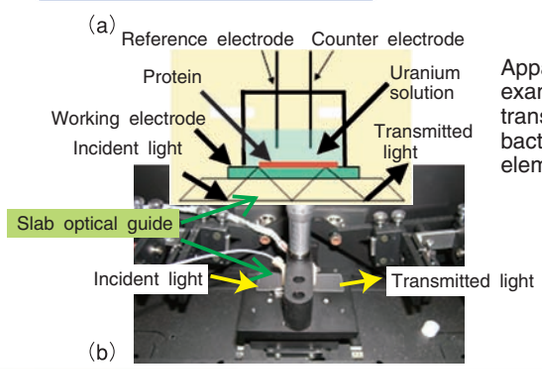
Actinide Material Science



Discovery of the first Np-based heavy fermion superconductor with large upper critical magnetic field (500,000 times of the geomagnetism)

$NpPd_5Al_2$ high quality single crystal

Material and Life Sciences



Apparatus for examining electron transfer between bacteria and heavy elements.

Fig.6-1 Four Research Fields and Collaboration in Advanced Science Research Center