

Tritium

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2019. 12. 6

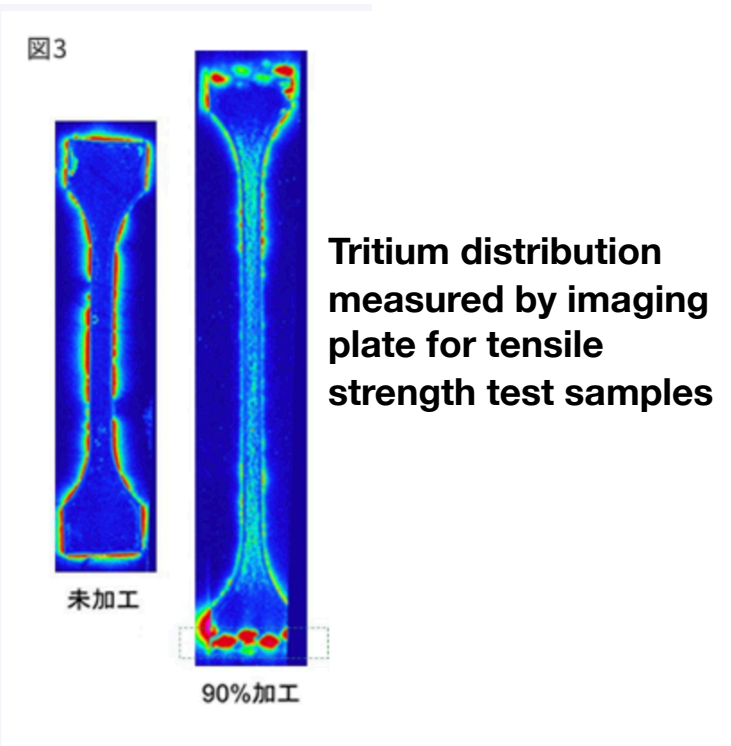
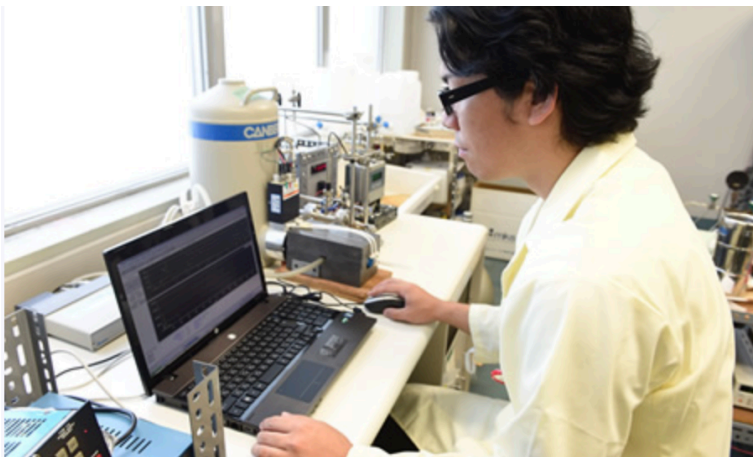




- **Tritium release from iron became an issue**
 - In NuMI, tritium release from steel wall to the air at high T
 - In J-PARC, tritium release from steel wall to the cooling water or He gas at low T
- **Possible measurements of tritium release?**
 - Tritium mobility inside metal can be known by many useful past measurements
 - Any limitation by surface effects?
 - There are extensive discussions inside J-PARC on necessity of measurements
 - Kawamura-san leads the discussions
 - He also performs some measurements in Hydrogen Isotope Research Center (HIRC), University of Toyama <http://www.hrc.u-toyama.ac.jp/en/>
 - Some collaborative work between J-PARC and HIRC will be organized

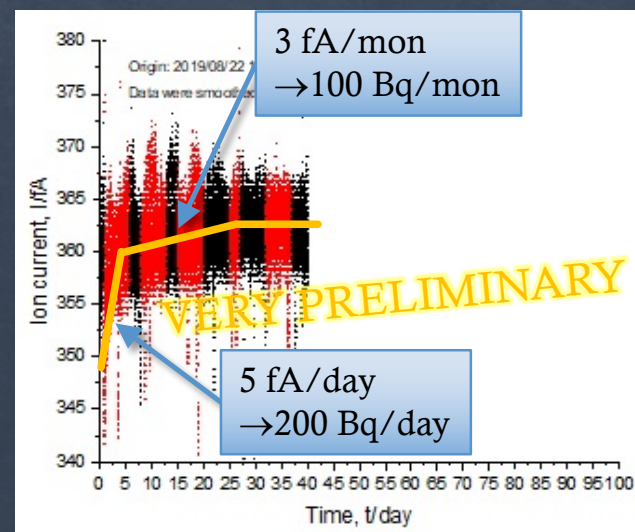
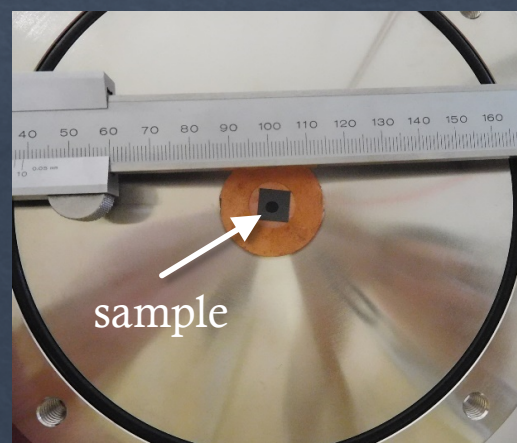
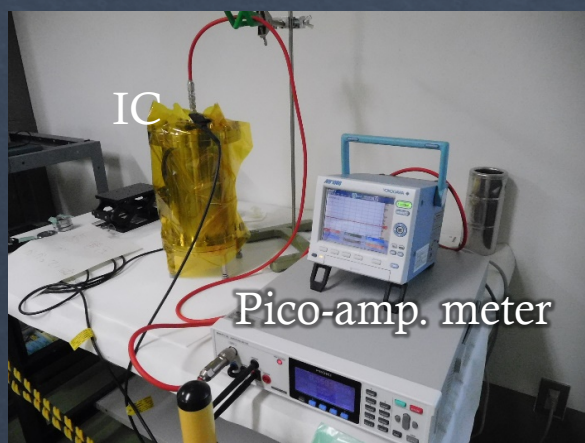
- **Tritium research activities in HIRC**

- http://www.hrc.u-toyama.ac.jp/en/research/nuclear_fusion.html
- Tritium measurement for gas, liquid and solid phases
 - Beta-ray induced X-ray spectrometry : detection of photons induced by tritium beta-rays
 - High sensitivity calorimeter : detection of heat generated by tritium beta-rays
- Interaction of tritium with materials and its control
- Visualization of hydrogen with tritium
- Tritium storage, supply and recovery



Tritium release from the surface

- ◇ **Tritium release from the surface** of IG-430U is being measured.
 - ◇ ^3H are injected into an IG-430U sample by an ion gun in **Toyama U.** 1.3 MBq of ^3H are stopped at <30 nm from the surface.
 - ◇ The sample is stored in the ionization chamber (IC) filled with the air to monitor the long-term evaporation from the surface.
 - ◇ The measurement is on going.
Evaporation rate seems to be slower than our experience in MLF??

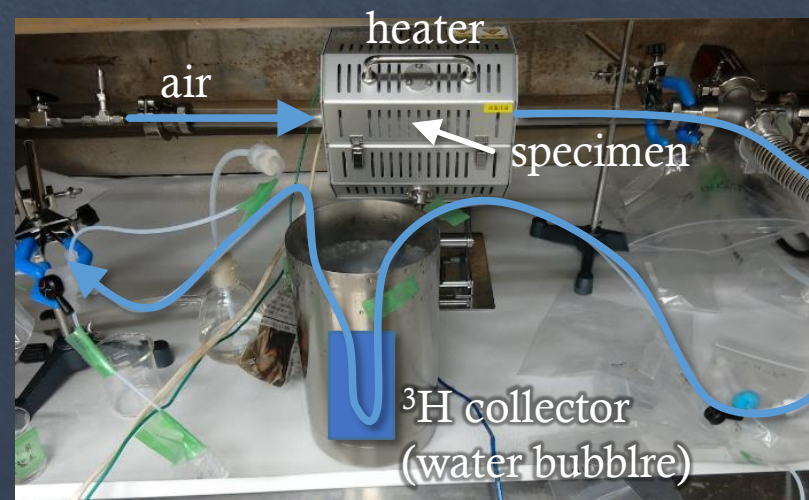


Tritium diffusion

- ◇ Tritium release from irradi. IG-430U samples were studied by TDS.
proton irradiation by RCNP cyclotron; 392 MeV, 0.5 μ A, 30 min

Date	est.	'17/6/14 Sample #3	'17/8/29 Sample #4	'17/12/25 Sample #2A		'17/12/26 Sample #3A	
Storage cond.		Just after irradiation	In vacuum For 2 mon.	In the air For half a year		In the air For half a year	
TDS cond.		oxidation (full recovery)		400 deg C 1 hour	oxidation (full recovery)	800 deg C 1 hour	oxidation (full recovery)
Collected amount of ^3H [Bq]	1700	800	770	0.4	774	7.0	891

- ◇ 7.0 Bq of tritium in #3A specimen may be due to contamination of the line by 2A.
- ◇ Below 800 deg C, tritium is not/hardly diffused in IG-430U, and is not/hardly evaporated out.





- **Possible measurements?**

- Tritium release from iron plate with/without black skin
 - in dry-air/vapor conditions
 - in He/He+vapor conditions
 - in water condition
- Irradiated sample by ion gun or in-situ irradiation (in J-PARC or NuMI)?
- One measurement will take continuous two-three months
- Remote measurements in HIRC is not desired (due to lack of man-power in HIRC)

- **Possibility to make simple measurement setup?**

- On-site measurement is desired
- Discussion on making a setup in J-PARC \Rightarrow HIRC is willing to help
 - Possible in-situ irradiation inside He vessel can be done in JFY2021
- Is it desired if similar setup is made in Fermilab?
 - Many chance to make irradiation sample in NuMI?