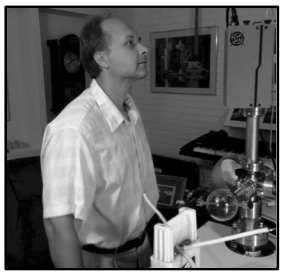
Synthesis of Lanthanides on Nickel Anode



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In April of 2017 I have conducted a replication of Sternglass' neutron synthesis experiment [1] using nickel 20Cb3 alloy 1" round bar for anode instead of copper as follows:

- I used a demountable X-ray tube filled with hydrogen at 0.01 Torr;
- Using Spellman DC power supply I have created a ~30 kV/20 mA electron beam via field emission from cold aluminium cathode;
- I was turning the beam on and off in 3-minute intervals and recording neutron counts per minute using a bank of five helium-3 detectors protected by a 4-mm thick solid-steel Faraday cage; the average counts were 39.0 CPM during the beam-on and 28.7 CPM during beam-off intervals (P = 0.0007).
- The entire experiment lasted for about 20 minutes and towards the end the electron mean has created a noticeable crater on the anode – Fig. 1.

Just now I analysed the anode in the Amray 1830 electron microscope fitted with Si(Li) EDS and determined that almost the entire bottom of the crater is coated in lanthanides. Lanthanides (primarily Lanthanum, Cerium, Praseodymium and Neodymium) are visible to naked eye as a yellow spot that covers the area of approximately 3 mm^2 (Fig. 1 – Left). EDS spectrum of the area (Fig. 1 – Right) reveals that lanthanide peaks completely dominate the EDS spectrum with *all of the expected peaks clearly resolved*; there are no nickel peaks present in the densest spots (not shown).

Conclusion: 30 kV/20 mA electron beam impinging on nickel anode in hydrogen atmosphere results in well-resolved neutron flux and apparently causes profuse transmutation that creates macroscopic quantities of foreign materials (e.g. lanthanides) on nickel surface. In the next series of experiments I am planning to capture high-resolution X-ray, neutron and gamma spectrum in real time as well as conduct a systematic analysis of the anode before and after the experiment to put quantitative limits on the amount of new elements produced and achieve better control of the process.

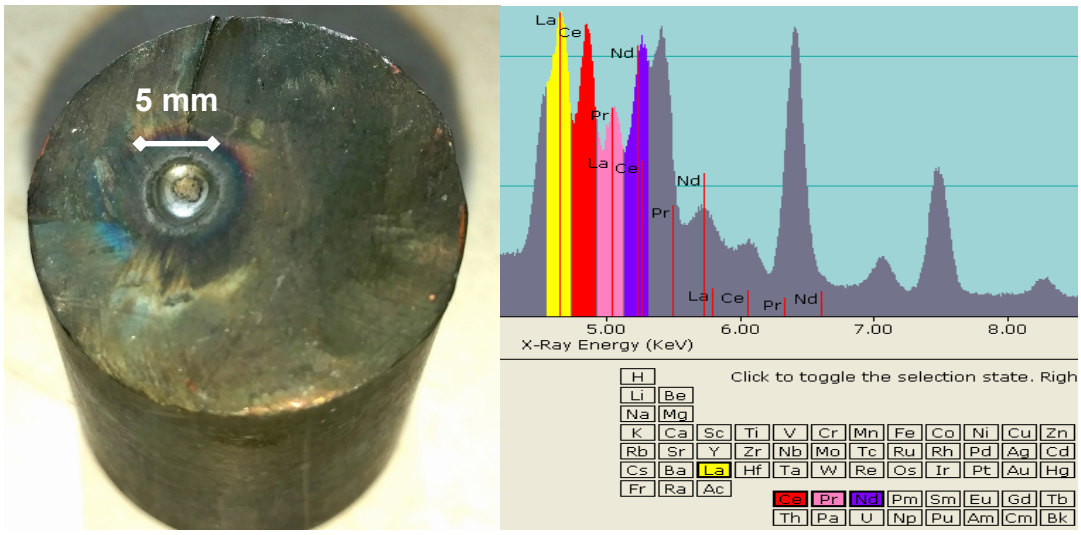

Fig. 1. Left – lanthanide area (yellow) at the bottom of the crater formed on nickel anode by electron beam; Right – lanthanides are prevailing elements in the area, their peaks dominate EDS spectrum.

[1] M. Fomitchev-Zamilov, Neutron Synthesis via Arc Discharge in Low-Pressure Hydrogen Plasma: Successful Replication of Earnest Sternglass Experiment, ICCF20, Sendai, Japan, 2016