



Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office via the User Portal:
<https://www.esrf.fr/misapps/SMISWebClient/protected/welcome.do>

Deadlines for submission of Experimental Reports

Experimental reports must be submitted within the period of 3 months after the end of the experiment.

Experiment Report supporting a new proposal (“relevant report”)

If you are submitting a proposal for a new project, or to continue a project for which you have previously been allocated beam time, you must submit a report on each of your previous measurement(s):

- even on those carried out close to the proposal submission deadline (it can be a “*preliminary report*”),
- even for experiments whose scientific area is different from the scientific area of the new proposal,
- carried out on CRG beamlines.

You must then register the report(s) as “relevant report(s)” in the new application form for beam time.

Deadlines for submitting a report supporting a new proposal

- 1st March Proposal Round - **5th March**
- 10th September Proposal Round - **13th September**

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report in English.
- include the experiment number to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.



	Experiment title: Investigating the coordination of PtAg Nanoclusters in ZIF-8 by in situ HERFD-XANES studies	Experiment number: MA-5353
Beamline:	Date of experiment: from: 05.07.2022 to: 11.07.2022	Date of report: 07.10.2022
Shifts:	Local contact(s): Dr. Viktoriia Saveleva	<i>Received at ESRF:</i>
Names and affiliations of applicants (* indicates experimentalists): *Lars Klemeyer ¹ *Dr. Jagadesh Kopula Kesavan ¹ *Prof. Dr. Dorota Koziej ¹ Dr. Lizhen Chen ¹ Assist. Prof. Dr. Indranath Chakraborty ¹ (now: Indian Institute of Technology Kharagpur, India) Prof. Dr. Wolfgang Parak ¹ 1) (Center for Hybrid Nanostructures, Institute for Nanostructured and Solid-State Physics, University of Hamburg, Luruper Chaussee 149, 22761 Hamburg)		

Report:

Metal NanoClusters (NCs) are a new class of material with ultrasmall size (typically 1-2 nm) and possess unique optical properties which are different than of plasmonic NanoParticles (NPs) analogues.^{1,2} NCs alloys have gained increasing attention due to their enhanced physiochemical properties (improved stability, optical performance, catalytic activity, etc.) compared to their corresponding homo-metal NCs, and thus benefit their further electronic, optical, and catalytic applications. Few successes on forming PtAgNCs were studied because of the large miscibility gap among them to form the alloy for enhanced catalytic performances.³⁻⁶ Increasing attention have been devoted to the NCs synthesis in the template of metal-organic frameworks (MOFs), due to their high porosity with well-ordered nanopores, and great thermal stability.⁷ Despite the distinct optical properties of NPs-MOFs and NCs-MOFs, which are easily measurable with optical methods, so far there is only report available on NPs alloys formation mechanism in MOFs template⁸ but none on their NCs analogues.

We successful performed the proposed experiment at ID26. For this, we developed an injection-cell which enable the injection of freshly prepared NaBH₄ that trigger the proposed reaction immediately. The reaction from K₂PtCl₄ towards Pt Nanoclusters and also the reaction from Pt Nanoclusters towards PtAgNCs were observed at the Pt L₃ and Zn K-Edge.

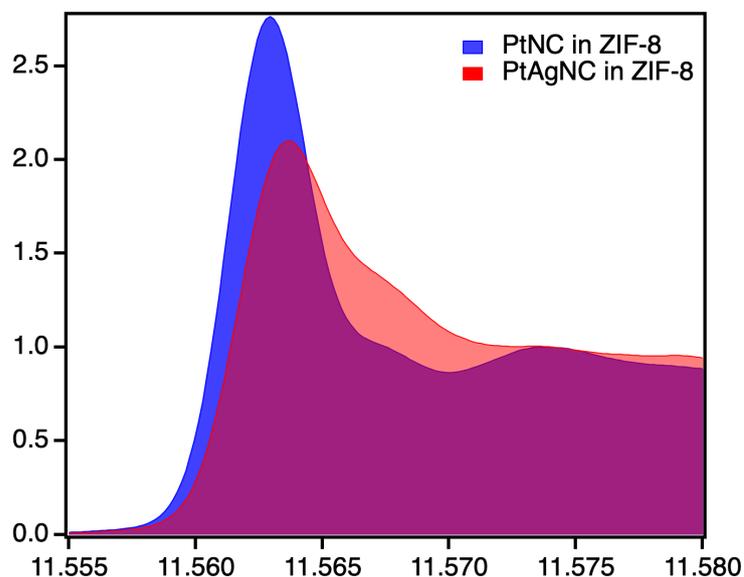


Figure 1: in-situ doping of PtNCs@ZIF-8 with Ag reveal an high impact of low Ag concentration on the electronic properties of PtNCs@ZIF-8.

The overall beamtime went successfully, the aquired data hides many unclear secrets which need additional time to get resolved. Therefore, it is unfortunately to early to draw a final scientific conclusion on this. To fully understand this impact, additional reasearch and simulations are required, witch are currently under operation.

- 1 Chakraborty, I. & Pradeep, T. *Chemical Reviews* 117, 8208-8271(2017).
- 2 Zeng, Y. et al. *J Am Chem Soc* 143, 9405-9414 (2021).
- 3 Peng, Z., et al. *Advanced Functional Materials* 20, 3734-3741 (2010).
- 4 Kim, K., et al. *The Journal of Physical Chemistry C* 115, 23374-23380 (2011).
- 5 Fang, C., et al. *Nanoscale* 8, 14971-14978 (2016).
- 6 Song, P. et al. *Inorganic Chemistry Frontiers* 5, 1174-1179 (2018).
- 7 Jiang, H.-L. et al. *J Am Chem Soc* 133, 1304-1306 (2011).
- 8 Su, Y. et al. *Nano Research* 12, 625-630 (2019).