

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA20129

Grantee name: Samrat Saha

Details of the STSM

Title: Ion beam induced dissociation of Fe(CO)₄-Acrolein and implications for FIBID

Start and end date: 15/09/2024 to 21/09/2024

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

(max. 500 words)

The STSM mission went as per the plan. I got the opportunity to get myself familiarized with the ECR ion source and work in an international research facility like GANIL. Initially we measured the background without the desired molecular sample. Then we were able to produce an effusive molecular beam of the sample. We measured for the fragmentation mass spectra of Fe(CO)₄-Acrolein with projectiles like He⁺ at 16 KeV, Ne⁺ at 6 keV, Ne⁴⁺ at 40 keV using the COLIMACON set-up in ARIBE low-energy beamline at CIMAP laboratory, GANIL, France. In between we also measured the background before starting the measurements with each projectile. I learned about their data acquisition system. For the analysis of the data, I became familiar with an open-source data analysis framework CERN Root. I have started learning more about CERN Root to enhance my capabilities and understanding in analyzing experimental data.

¹ This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

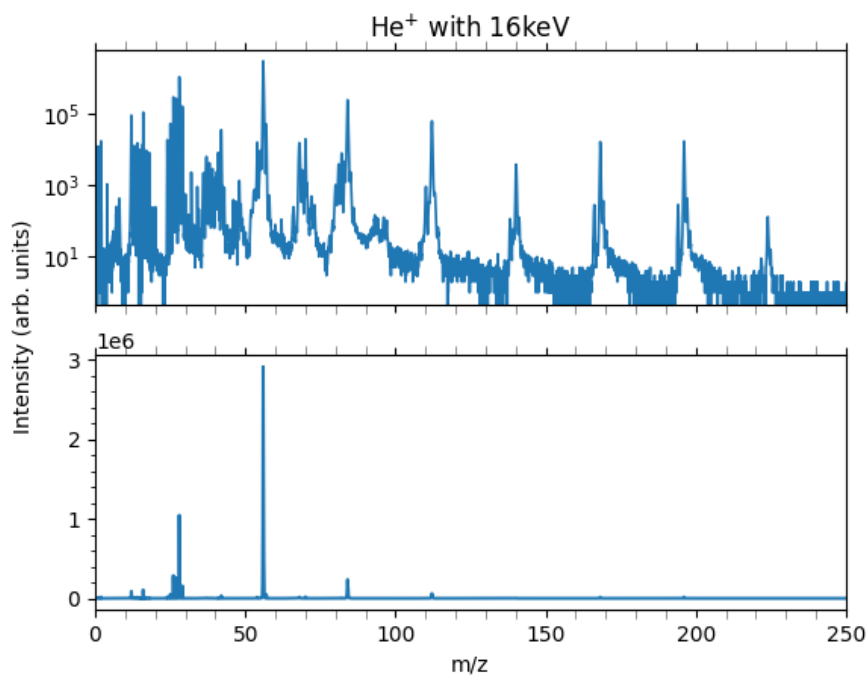


Figure 1. Mass spectra of Fe(CO)₄-Acrolein fragmentation by the impact of singly charged He⁺ projectile with energy 16 keV.

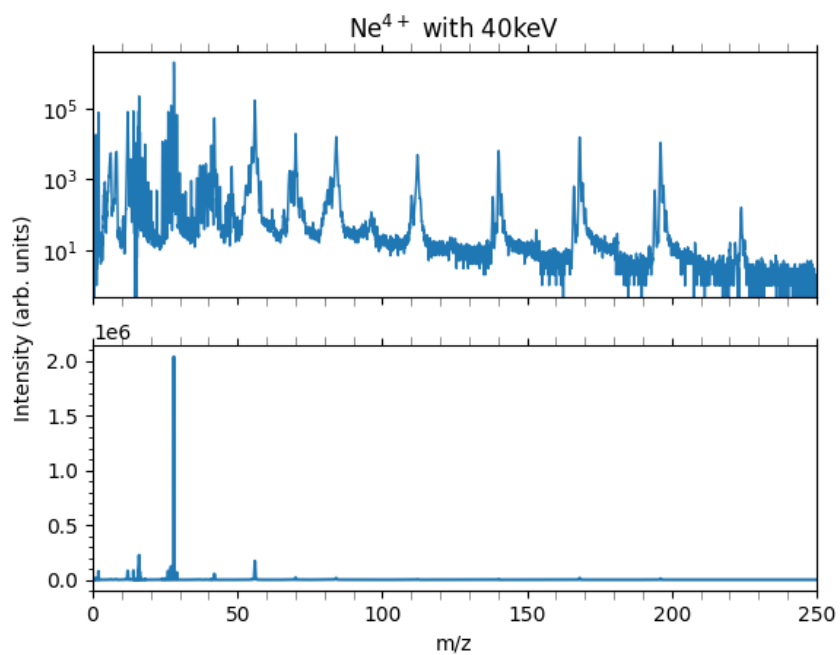


Figure 2. Mass spectra of Fe(CO)₄-Acrolein fragmentation by the impact of Ne⁴⁺ projectile with energy 40 keV.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

(max. 500 words)

Grantee enters max 500 word summary here.

The initial results have shown promising fragmentation patterns which is added in this report in Figure1 and Figure2, and we were able to identify significant fragmentation of the $\text{Fe}(\text{CO})_4$ -Acrolein, mainly with the formation of Fe^+ fragments. This is a raw data before proper analysis.

I became familiar with CERN Root software. I already installed the software in my laptop and started analysing the data. Our future goal is to finish the analysis as soon as possible. This will result into a peer reviewed article. These are the stated deliverables of WG4 of the COST action.

The project aims to compare these results with electron beam-induced dissociation data from our Prague lab to evaluate the similarities and differences between the two processes. This plays a vital role in inter-technology exchange involving nanofabrication techniques. This is connected to the task T3.2 of WG3 of MultiChem.

This data produce a deeper understanding of how this novel precursor molecule behaves under different beam conditions and will aid in the future application of $\text{Fe}(\text{CO})_4$ -Acrolein in focused ion beam-induced deposition (FIBID) for nanofabrication purposes. Atomistic level investigation of irradiation driven processes in FIBID precursor molecules contribute to task T1.3 of WG1 of Cost Action.

We believe the generated data will help in expanding the database and databank for the FEBID related molecules directly in line with task T1.5 of WG1.

This project has established three collaborations, and we already agreed on some future plans to conduct similar experiments in near future.