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Charge Injection Studies of MXenes/TiO₂ Nano-Composite and Aluminum Nanohole Array (Reactive Chemical Systems)

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Data Management Plan

Data to be generated in the proposed project include experimental details recorded by hand in laboratory notebooks as well as digital data. Data will be saved as ASCII from Labview or equipment. Pictures will be saved as .jpeg.

1) Management of laboratory notebooks

Experimental details will be recorded on a daily basis. The main experimental data must be printed and pasted on notebooks. File names in the notebooks should be consistent with those in the digital data. The images of every experimental setup for the data should be taken and pasted on notebooks.

2) Management of digital data

Digital data includes raw digital data from instrument outputs, analyzed data, and figure data.

Raw digital data from instrument outputs are stored on laboratory workstations at Utah State University, which is synchronized with Box and the personal computers of the experimental performers and the PI. The data are transferred to the department's server biweekly. Thus, both the experimental performers and the PI could see the data immediately. The transfer ensures three local copies and two remote copies for redundancy. The file folders for raw data are named in date. The file names for raw data are named as the following: Date_Key words_Who. For example, 10-10-2017_SHG on 10 uM aerosols_Rao.

Analyzed data are divided into preliminary analyzed data and further analyzed data. Analyzed data are also stored on Box.com, which are synchronized automatically and uploaded to the department server biweekly. The workstations and servers are backed up daily to external hard drives. The analyzed data will be analyzed and archived using Igor, Microsoft Excel, and Matlab.

Preliminary analyzed data: File folders and file names for the preliminary analyzed data follow those for Raw Digital Data from Instrument Outputs. In other words, these are organized in order of *Date*.

Further analyzed data: A) File folders for the further analyzed data are organized in *Topic*. B) File names for the further analyzed data should keep both dates which the data are analyzed and acquired. For example, one is analyzing the data on 07-08-2017 (today is 10-10-2017). The file name should be 10-10-2017_key words_07-08-2017_Rao. Therefore, the data and analysis will be tracked.

Figure data are chosen from the further analyzed data. The file names are the same as the further analyzed data. Final versions of analyzed data will be published in the peer-reviewed literature. After the closing of the project, analyzed data, filed according to the corresponding peer-reviewed publication, will be archived through Utah State University Libraries in the Institutional Repository Digital Commons@USU, as described below. Data Access and Sharing outside the research group will primarily take place via the peer-reviewed literature, and the journal archives will provide a long-term, publically accessible record of the work. However, analyzed data will be provided to collaborators and others upon request.

3) Deposit and storage of data

Utah State University, through the Merrill-Cazier Library, provides institutional repository services. Data files are fully described and published articles can link to the data sets via persistent URLs or a DOI. All files are backed up at multiple sites, including cloud storage. Preservation copies are stored in Amazon Web Services, with redundant storage across multiple facilities and are regularly verified for integrity of data using checksums. Data are freely and openly accessible to the public, and all file types are accepted.

During the research project, files deposited in Box and the department's server are written to a disk cache in an Oracle SAM-FS file system once a year and is stored at the PI's office. Box.com is a cloud storage system used by Utah State University. Files are backed up nightly at multiple sites. Box.com ensures data integrity, includes version control, and is password controlled and encrypted.

Hard-copy laboratory notebooks will be stored in the Rao Group office. Once individual researchers leave the project, their laboratory notebooks will be stored in the PI's office indefinitely.

4) Professionalism committee for data management

A professionalism committee in the Rao laboratory has been established. The committee members are assigned by the PI and reassigned every year. The primary job of the committee is to assist to educate new group members, to check both the data every month, and to advise new data management to the PI. The execution of backups in Box is conducted by the laboratory personnel. The department server is maintained by a professional staff. The PI holds primary responsibility for data management.