A Seeded Extreme-UV Free Electron Laser System at Dalian

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Fundamental research in basic energy science is very important to the development of clean energy sources as well as the optimization of fossil energy use, because energy uses and productions are essentially chemical and physical processes. The development of new light sources, such as table laser running at visible range, synchrotron radiation at X-ray, for studying energy systems has been a key in this field. Extreme VUV light sources have been very useful for efficiently detecting and ionizing important molecular species in one photon excitation. However, strong light sources in the EUV region are difficult to obtain with commercially available laser systems using non-linear optics scheme. Although EUV synchrotron radiation is a good tool for near CW type experiment in this wavelength range, time-resolved dynamics studies of molecular energy processes usually need powerful pulsed EUV laser sources. Recently development in the FEL science, especially the seeded high gain high harmonic technique (HGHG)[1,2], have provided us an excellent chance to acquire strong EUV light sources for experimental studies in basic energy science. This type laser source could provide strong laser light that is several orders more intense than current available light sources and is useful for efficient detection of molecular and radical species. Such EUV light source is basically a femtosecond pulsed laser that is excellent for ultrafast dynamical experiments.
A project to build a new seeded free electron laser, operating at extreme UV range between 50nm and 150nm, at Dalian has been recently funded by the National Science Foundation of China. This is a collaborative project by the Dalian Institute of Chemical Physics (DICP) CAS and the Shanghai Institute of Applied Physics (SINAP) CAS. A conceptual design[3] of FEL will be present at this workshop. The FEL uses a 300 MeV electron beam with picosecond duration from normal conducting S band Linac. The electron beam is then modulated at the first short undulator by a seed laser. The high harmonic in the extreme UV range is generated and amplified in a region of several undulators downstream. The designed EHV FEL will produce about 100uJ per pulse with a repetition rate of as high as 50 Hz. User experimental stations in the studies of molecular beams and surface dynamics will also be built at the same time[3]. This will ensure immediate usage of the FEL light source once it is completed. Related research plans using this light source will be also presented.

Ref
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