foreword

Frontiers in Femtochemistry

I am indeed very pleased to write this foreword for the special thematic issue of the BARC Newsletter on the spectroscopic research using femtosecond laser in the Chemistry Group, BARC. Laser based time-resolved spectroscopic research was initiated in the Chemistry Group to generate short-lived reactive species and study their reaction kinetics and dynamics by following their time evolution. These studies have helped to unearth the mechanistic insights of important chemical and biological processes. Considering its immense applications in several fields like photosynthesis, light harvesting and other photochemical reactions, this frontier research area has grown rapidly in a very short time in the Chemistry Group keeping pace with the international standard. Chemistry Group has gained reach experience in the research area of spectroscopy and chemical dynamics by setting up various research facilities from millisecond to femtosecond timescales. To compete with international laboratories against all the odds, our scientists in the Chemistry Group took up the challenges and indigenously developed a femtosecond laser-based multistage dye amplifier and a transient absorption (TA) spectrometer, which is the first of its kind in India. This spectrometer records snapshots of chemical reactions with femtosecond time resolution.

The successful development of such a spectrometer has significantly boosted the femtosecond laser-based spectroscopy research in the Chemistry Group. Subsequently, several state-of-the-art picosecond and femtosecond laser laboratories have been developed indigenously to study not only the chemical structure and dynamics in bulk, but also at interfaces. The advantage of the high peak power of these lasers has been exploited for different spectroscopic applications, like Vibrational-Sum-Frequency-Generation (VSFG) spectroscopy to study the molecular interaction and their orientation at the interface; and Laser-Induced-Breakdown-Spectroscopy (LIBS) for elemental analysis with high sensitivity and selectivity. Recently, a tabletop setup for the generation of short-pulse electrons in water has been developed to study the reaction of electrons in femtosecond time scale.

Femtolasers are now invaluable not only for observing chemical processes in real time but also for manipulating the chemical reaction to produce a desired product. These are also very commonly being used by industry for critical material processing and the medical fraternity for treatment and diagnosis purposes. Inputs from these spectroscopic studies are the basis for such deployment of the femtolasers for the benefit of mankind.

This special thematic issue will enrich the scientific community about the expertise on the femtosecond laser spectroscopy available in Chemistry Group. I am confident that with this awareness the scientific community will be in a position to explore the possible use of these facilities for departmental activities. This will also encourage collaborative work with other organizations. I congratulate all the authors and the SIRD editorial team for the timely release of this special issue on femtosecond spectroscopy.

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