**Phase separation and X-ray generation induced by laser irradiation: mechanisms and applications to materials science**

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Pulsed lasers have been used for studying a variety of laser-induced chemistry. In this presentation, two extreme phenomena induced with pulsed lasers will be introduced. One is very mild case: no chemical reaction is involved and only inter-molecular bond scissions are induced with IR pulses. The other one is very intense case: electrons are ejected and accelerated under intense laser field resulting in plasma formation. The former case can initiate phase separation of binary liquid mixtures, while the latter case can generate ultra-short X-ray pulses from the laser-induced plasma. The mechanism involved in the two cases will be discussed from viewpoints of physical chemistry. Applications of these phenomena to materials science will be also presented.