THE ULTRA-FAST PULSE RADIOLYSIS SYSTEM APPLIED TO HIGH TEMPERATURE RADIOLYSIS [P-20]

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An ultra-fast pulse radiolysis system based on pulse-and-probe method has been developed. It consists of a 22 MeV S-band electron linac and a femtosecond Ti:Sapphire laser[1,2]. Half of the fs laser (795 nm) is injected into a laser photocathode RF-gun to generate electron beam after converting into third harmonics (265 nm), and another is used as a probe laser which is converted into valuable wavelengths (535 – 2600 nm) by an optical parametric amplifier.

This system has been utilized to study initial yields and transient behaviors of presolvated and solvated electrons in water and various kinds of alcohols by now. But those experiments were capable only at ambient condition (room temperature and atmospheric pressure). In spite that high temperature radiolysis work has been intensively done by usage of hitherto nanosecond pulse radiolysis system, the direct trace of the transient phenomena was practically impossible due to the fact that reaction rates are remarkably enhanced at high temperatures. Therefore, it will be very valuable with the help of the picosecond pulse radiolysis system.

In the ambient condition experiment, a thin quartz cell is generally used for a sample cell. However, in the high temperature experiment, a cell made of alloy which can withstand high temperature and pressure should be used. As the incident electron beam can penetrate less efficiently through such robust cell, dose will decrease so much, resulting in the decrease of signal-to-noise ratio. Therefore, improvement of the laser photocathode has been carried out in order to increase the charge of the electron beam. Accordingly, setup of the high temperature – picosecond pulse radiolysis system as well as preliminary experiment was performed.

[1] Y. Muroya, M. Lin, Y. Katsumura et al., Nucl. Instr. Meth. A, ***2002****, 489, 554*
[2] Y. Muroya, M. Lin, Y. Katsumura et al, Res. Chem. Intermed., ***2005****, 31, 261*