New laser system installation for PALIS

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A new laser system for PArasitic slow RI-beam production by Laser Ion Source (PALIS)[1)] has been installed. This system has higher laser power and repetition rate compared to those previously we used. A gas-jet laser spectroscopy can be applied owing to high repetition rate. A room partition was recently constructed for the laser equipments having laser shield noise barriers. The room is complete with an air conditioning system.

So far, we have developed a resonant ionization laser system and a new laser ion source configuration for future PALIS project. Old laser components consist of two pulsed dye lasers (Lambda Physik) pumped by two excimer XeCl lasers (Lambda Physik). The maximum power and repetition rate for the excimer laser is 150 mJ/pulse, 200 Hz, which corresponds to 30 W. Additionally, Ti:Sapphire laser pumped by YLF laser (10 W, 1 kHz) is available through collaboration with Nagoya university. By using these lasers, off-line resonant laser ionization for stable Co, Cu, Fe, Ni, Ti, Nb, Sn, In, and Pd inside the gas cell, ion extraction and transport to high-vacuum region via SPIG and QMS have been confirmed[2)]. The feasibility study for the gas jet laser spectroscopy was investigated in combination with dye and TiSa lasers[3,4)].

In terms of the efficiency of the gas cell based resonant laser ionization system, the laser power and its duty cycle are important. The ionization efficiency depends on the atomic transition strength determined by the type of the element. High power lasers are widely adopted for a number of elements. Moreover when the moving speed for photo-ionized atoms increases as in the case of ionization inside a gas jet, the duty cycle of the laser pulse should be set suitably high[5)]. Thus, a high power and high duty cycle laser is necessary to realize a higher performance PALIS system.

In FY2013, the construction budget for a low-energy RI-beam facility SLOWRI was finally founded. New high power, high duty cycle lasers were prepared for PALIS experiments. In order to install the new laser assembly, the room size for laser setting and off-line experiment was also extended.

New laser components consist of two pulsed dye lasers pumped by one YAG laser. The maximum repetition rate and power for a YAG laser (Edge wave) is 10 kHz and 90 W for 532 nm with a single mode and 36 W for 355 nm and 40 W for 532 nm with a multimode. Two pulsed dye lasers (Sirah) provide a wide range wavelength from 215 to 900 nm with about 10 W for fundamental frequency and 1 W for a frequency-doubled by a secondary harmonic generator. These dye lasers accept both wavelengths (355/532) from pump laser beam and have an additional option for selecting a line width of 1.5 GHz and 6 GHz, alternately. Additionally, a new YAG laser (Lee) was installed for pumping Ti:Sapphire lasers. The maximum power and repetition rate is 50 W and 10 kHz, respectively. An injection locked Ti:Sapphire laser operated at up to 10 kHz with a line width of 20 MHz will be prepared for high precision laser ionization spectroscopy.

Fig. 1. The photograph of new PALIS lasers: shining two dye lasers pumped by YAG laser.

We confirmed that the new laser system works with a reasonable performance. Fig. 1 shows a photograph taken during tests of the new lasers in October 2013. The off-line and on-line commissioning test for PALIS will begin from April 2014.

References

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