MS36-P4 Focusing-optics laser assembly for modern photocrystallography: technical design and performance

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Photocrystallography is defined as a set of crystallographic techniques applied to study light-induced dynamic processes occurring in crystals. Over the last several years there is a rapid growth in this field, including studies on chemical reactions,[1] low-temperature metastable states,[2] and even on electronic excited states.[3] Many of these investigations are performed employing synchrotron sources where it is easier to install light delivery devices when compared to home diffractometers, for which a limited set of solutions currently exists.[4,5]

Consequently, here we describe our own setup for the purpose of conducting photocrystallographic experiments using home diffractometers. The whole system consists of adjustable laser-focusing optics and a holder, which can be conveniently mounted as additional sample conditioning device (Figure 1). Current setup is designed to work best with Bruker-type diffractometers, yet can easily be extended for other types of commercially available SXD machines. The holder allows for implementation of various optics (with different focusing lengths), but more importantly, for reducing the goniometer-collision areas to absolute minimum (the assembly does not obstruct fixed-chi goniometer). The laser light is delivered through the fibre optics, which assures full flexibility in choosing the light source. Thus, one can equally-well attach large-box high-power lasers and simple LEDs (which can be controlled by our home-made electronics). In our opinion, the designed laser assembly has certain advantages over other solutions tested previously, especially in terms of X-ray safety (the light source can be stored outside the radiation-safety enclosure), and available flexibility in selecting the laser wavelength.

The laser assembly has been tested by performing various solid-state transformations. These included either well-known [2+2] photo-dimerization reactions of cinnamic acid derivatives,[1] or metastable linkage isomers in nickel(II) complexes.[6] The experimental results shall be presented here in details, together with the technical aspects of the laser assembly.

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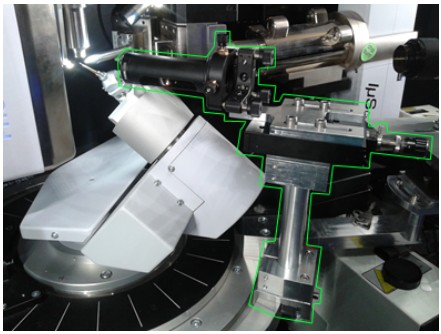

Figure 1. New versatile laser-focusing assembly (outlined in green) as mounted on the single-crystal diffractometer.

Keywords: photocrystallography, laser assembly, photo-induced transformations