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An optical cryostat for use in Microscopy cooled by a Stirling-type pulse tube cryocooler

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The few products of optical cryostat for use in Microscopy and Spectroscopy in the market are generally cooled by liquid nitrogen, liquid helium or cryocoolers such as G-M cryocooler or G-M type pulse tube cryocooler (PTC), as sometimes it is not convenient to use G-M cryocooler or G-M type PTC because of its noise and big size; and in some places, liquid nitrogen, especially liquid helium, is not easily available. To overcome this limitation, an optical cryostat for use in Microscopy and Spectroscopy cooled by a Stirling-type pulse tube cryocooler (SPTC) has been designed, built and tested.

The refrigerator system SPTC is an important component of the optical cryostat; it has the advantages of compactness, high efficiency, and low vibration. For simplification and compactness, single-stage configuration with coaxial arrangement was employed in the developed SPTC. In order to lower the vibration, the separated configuration was adopted; its compressor and pulse tube are connected with a flexible connecting tube. The effects of the length and diameter of the connecting tube on the performance of the cold head had been tested. The key sizes of the cold tip such as the length and diameter of the regenerator and pulse tube, the opening of the multi-bypass, the volume of the reservoir et al, are kept the same with the integral structure which we have reported before; and the performance difference between the separated structure and integral structure will also be described in this paper.

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