Ultraviolet laser-induced damage characteristics of 70% deuterated potassium dihydrogen phosphate crystals

Pengcheng Wu,[1,3,#] Yafei Lian,[2,#] Lisong Zhang,[1,3] Hongkai Ren, [1,3] Mingxia Xu,[1,3] Tingting Sui,[4] Xun Sun,[1,3] Baoan Liu[1,3,*] and Jin Huang[5]
*lead presenter: baliu@sdu.edu.cn
[1]State Key Laboratory of Crystal Materials, Shandong University, Jinan 250100, China
[2]Laboratory of Thin Film Optics, Shanghai Institute of Optics and Fine Mechanics, Shanghai 201800, China.
[3]Key Laboratory of Functional Crystal Materials and Device, Shandong University, Ministry of Education, Jinan 250100, China
[4]Department of Physics, University of Science and Technology Beijing, Beijing 100083, China
[5]Research Center of Laser Fusion, China Academy of Engineering Physics, Mianyang 621900, China
# These authors contributed equally to this paper and should be regarded as co-first authors

Bulk damage of deuterated potassium dihydrogen phosphate (DKDP, KD_2PO_4) crystal can be induced by intense laser irradiation, severely restricting the output of high- power laser energy and the usage of DKDP crystals in high-power laser systems. In this paper, laser-induced damage threshold (LIDT) and damage growth characteristics of DKDP crystal under 355 nm laser irradiation were systematically studied. The bulk laser-induced damage (LID) density of the crystal increased exponentially with the laser irradiation fluence. LID closely relates to the growth defects called precursors. Laser conditioning could effectively enhance the LID resistance by modifying the precursors. The LID density of DKDP crystals decreases after laser conditioning, and the increasing conditioning fluence can reduce the LID density. Damage growth after the initial LID by 1-on-1 measurement is different from that by R-on-1 measurement since the process of R-on-1 measurement leading to initial LID is equal to the laser conditioning procedure. The study in this paper provides a reference for improving the application of DKDP crystal in high-power laser systems.[1]

References (if needed)

[1] Wu PC, Lian YF, Zhang LS, et al. Ultraviolet laser-induced damage characteristics of 70% deuterated potassium dihydrogen phosphate crystals. Opt. Mater. Express. 2022, **12**:2759-2771.