応用物理学会学術講演会予稿のタイトル

The dynamical structural changes in polymers induced by laser irradiation studied by spectrum-tuned 4D X-ray phase tomography based on X-ray Talbot interferometry

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The X-ray Talbot interferometry quantitatively measures phase shift of X-rays in a matter and thus, it is a promising technique to observe soft (low-Z) materials. The X-ray multilayer mirror with bandwidth of 0.1 was installed at beamline BL28B2 at SPring-8 synchrotron radiation facility to reduce radiation damage delivered to the soft-matter specimen. The X-ray Talbot interferometer was constructed downstream of X-ray multilayer mirror at beamline BL28B2 at SPring-8 facility. The polymer specimens of acrylic glass (PMMA) and poly(propyelene) (PP) were illuminated by high-energy infrared laser beam (λ=1064 nm) operating in continuous-wave (CW) mode and propagation of laser-induced pyrolysis in polymer samples was studied by time-resolved X-ray phase imaging. The pilot experiment included fixed sample position and a movie of differential phase images was recorded during laser irradiation with temporal resolution 50 ms. The measurement of movie of differential phase images was continued by 4D X-ray phase CT which provides dynamical change of 3D distribution of real component of index of refraction δ during laser irradiation [1]. The 4D X-ray phase CT using continuous phase stepping method was performed with temporal resolution 4 s. The reconstruction of CT images revealed that defects have character of conically-shaped voids. The growth of burnt area in PP material proceeds from the center of illuminated area to the sample edges (Figs. 1c-d) while in PMMA material, it proceeds from the margin of illuminated area to its center (Figs. 1a-b).

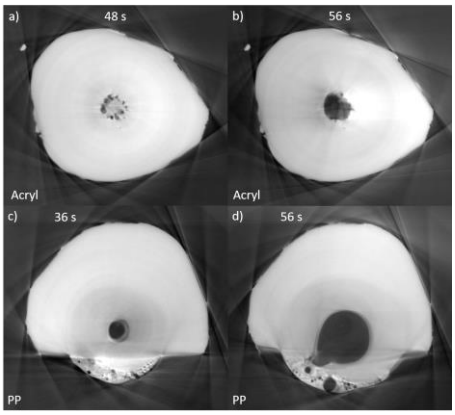

Figure 1. The CT slice images corresponding to the bottom of acrylic (PMMA) plate taken at a) 48 s and b) 56 s and the CT slice images corresponding to the bottom of PP plate taken at c) 36 s and d) 56 s during CW laser irradiation.

References

[1] A. Momose *et al.*, *Opt. Express* **19,** 8423 (2011).