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Development of a compact water window soft x-ray source based on multiply charged ion plasmas

多価イオンプラズマによるコンパクト水の窓軟 X 線光源の開発

○Thanh-Hung Dinh[1], Yoshiki Kondo[2], Goki Arai[2], Taisuke Miura[3], Akira Endo[3], Tetsuya Makimura[4], Tadashi Hatano[5], Takeo Ejima[5], and Takeshi Higashiguchi[1,2]

1. CORE, Utsunomiya Univ., 2. Utsunomiya Univ., 3. HiLASE Centre, 4. Univ. of Tsukuba, 5. IMRAM, Tohoku Univ.

○ ヂン タンフン[1]，近藤 芳希[2]，荒居 剛己[2]，三浦 泰祐[3]，遠藤 彰[3]，牧村 哲也[4]，羽多野 忠[5]，江島 丈雄[5]，東口 武史[1,2]

1. 宇都宮大オプト，2. 宇都宮大院工，3. HiLASE Centre，4. 筑波大院数理，5. 東北大多元研

E-mail: dinh@cc.utsunomiya-u.ac.jp

Imaging in the water window soft x-ray (SXR) region ($\lambda = 2.3 - 4.4$ nm) that benefits from the natural contrast between carbon and oxygen absorption is of great interest for the investigation of unstained biological samples [1]. To realize single-shot flash SXR photography within a laboratory system, the use of broadband and high-power water window SXR emission from laser-produced plasmas (LPPs) of high-Z elements has been proposed [2]. In this scheme, which uses reflective rather than transmissive optics, transitions that overlap in adjacent ion stages to yield intense unresolved transition arrays (UTA) provide an alternative to line sources.

In this study, we investigate performance of the multiply charged ion plasma sources and their applicability to x-ray microscopy. The output at the water window SXR region and the source size which are the key parameters when designing x-ray optical system have been evaluated as shown in Figs. 1 and 2, respectively. By using LPP of bismuth (Bi) as the illumination source of a SXR contact-type microscope, we also succeeded in single-shot flash imaging of a copper (Cu) micro-mesh, as shown in Fig. 3.

[1] A. Sakdinawat *et al.*, Nat. Photonics **4**, 796 (2010).

[2] T. Higashiguchi *et al.*, Appl. Phys. Lett. **100**, 014103 (2012).

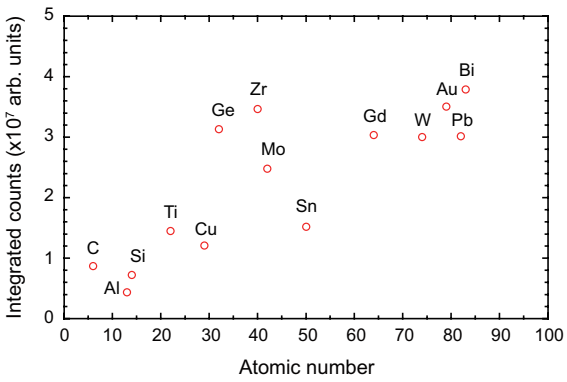

Fig. 1: The water window SXR ouptut (total counts) for various elements.

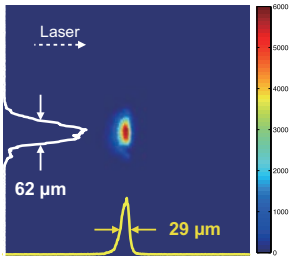

Fig. 2: Typical source size of 150-ps LPP of Bi.

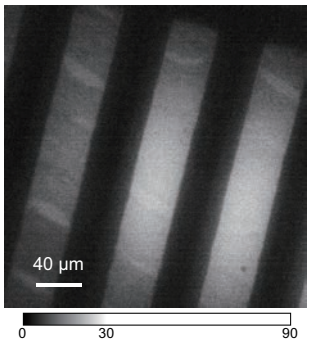

Fig. 3: A Single-shot flash image of a Cu micro-mesh by using the LPP of Bi as the illumination source of a SXR contact-type microscope.