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High harmonic generation from a multi-jet gas puff target for FEL seeding

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As a result of interaction of ultra-short, high power laser pulses with gases high-order harmonics generation (HHG) occurs. It is the most promising methods to obtain coherent radiation in the soft X-ray (SXR) and extreme ultraviolet (EUV) regions [1, 2]. This radiation is highly attractive for applications in various areas, including seeding of a free electron laser (FEL) [3].

Seeding of FEL with an external source will improve the temporal coherence, ensure high shot-to-shot stability and high peak power, and will decrease the saturation length. This method was presented e.g. on Spring-8 Compact SASE Source (Japan) [4] and FLASH FEL (Germany) [5].

In this paper we present the recent results of HHG experiments with the use of a multi-jet gas puff target, developed at the Institute of Optoelectronics, MUT [6]. The results should be useful for the development of an efficient, quasimonochromatic source of coherent EUV radiation [7], with potential application to FEL seeding.

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Extreme ultraviolet surface modification of fluoropolymers for biocompatibility control

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Recent advancements in organic materials as “Green Alternatives” in various applications dramatically increased the requirement of efficient surface modification technique which would be able to tune the surface properties without altering mechanical properties of bulk materials[1][2]. The thickness of such materials (e.g biosensors, bio-mimetic artificial implants, artificial muscles, organic electrodes for biomedical engineering applications, and many more) will be limited to few millimeters or up to few hundred microns in particular applications. The conventional ultraviolet (UV) and plasma based techniques produce undesirable effects such as alteration of bulk material properties. This problem limit their applicability in biomedical engineering applications. Extreme ultraviolet (EUV) photons with energies from 30 eV up to 250 eV (corresponding to wavelengths in vacuum from 40 nm to 5 nm respectively) have limited penetration depths (up to 100 nm) in to the polymer surface[3]. Therefore the modification of physical and chemical properties will be limited to upper layer surface and the bulk properties will remain intact. EUV photons can be produced by synchrotron radiation (SR) sources or laser-plasma sources. The limited number and accessibility to large scale SR facilities encouraged the development of compact laboratory EUV sources. Such sources are currently being used by a few groups to investigate new applications of EUV technology in various fields.

This study demonstrates the use of EUV surface modification technique in biomedical engineering applications. Micro and nano-patterned surfaces, functionalized with special reactive groups are often desirable for improved biocompatibility of various polymers in vascular prosthesis and tissue engineering applications. A number of polymers such as PC, PET, PTFE and PVF have been irradiated with a laser-plasma EUV source based on a double-stream gas-puff target, irradiated with the 3 ns/0.8J Nd:YAG laser pulse at 10Hz [4]. The EUV irradiated samples were characterized through SEM, AFM, XPS and water contact angle measurements. The irradiation of EUV photons on