# 有機薄膜からの CW レーザー発振

## Continuous-wave lasing from organic semiconductor films

九大 OPERA[1], JST/ERATO[2], 九大 I2CNER[3], ISIT[4], ○A. S. D. Sandanayaka[1,2]*, 松島敏則[1-3], F. Bencheikh[1,2], 吉田 巧[1], 井上棟智[1], 藤原隆[4], 合志憲一[1,2], J.-C. Ribierre[1,2], 安達千波矢[1-3]*

OPERA, Kyushu Univ.[1], JST/ERATO[2], I2CNER, Kyushu Univ.[3], ISIT[4], ○A. S. D. Sandanayaka[1,2]*, T. Matsushima[1-3], F. Bencheikh[1,2], K. Yoshida[1], M. Inoue[1], T. Fujihara[4], K. Goushi[1,2], J.-C. Ribierre[1,2] and C. Adachi[1-3]* E-mail: sandanay@opera.kyushu-u.ac.jp and adachi@cstf.kyushu-u.ac.jp

In this study, quasi-continuous-wave (quasi-CW) and true-CW photoexcitation surface-emitting lasing are demonstrated in a distributed feedback device which combines a mixed-order grating with an organic thin film of a host material 4,4'-bis(*N*-carbazolyl) -1,1'-biphenyl (CBP) blended with an organic laser dye 4,4'-bis[(*N*-carbazole)styryl] biphenyl (BSBCz).[1,2] The quasi-CW laser operation maintained up to a repetition rate of 80 MHz (Fig. 1a). Additionally, the true-CW laser operation was demonstrated even under 30 ms of long photoexcitation (Fig. 1b). This outstanding performance was achieved using a BSBCz:CBP blend film with high optical gain, high photoluminescence quantum yield and no triplet absorption losses[2] at the lasing wavelength along with a mixed-order distributed feedback grating to achieve low lasing threshold. Simple encapsulation of devices with CYTOP was a key method used to greatly reduce the laser-induced thermal degradation and suppress the ablation of the gain medium taking place under intense CW photoexcitation. The influence of pump pulse widths and the role of the CYTOP encapsulation were analyzed on the basis of thermal and optical simulation results. Overall, this study provides evidence that the development of true-CW organic semiconductor laser technology is possible via the engineering of the gain medium and the device architecture.

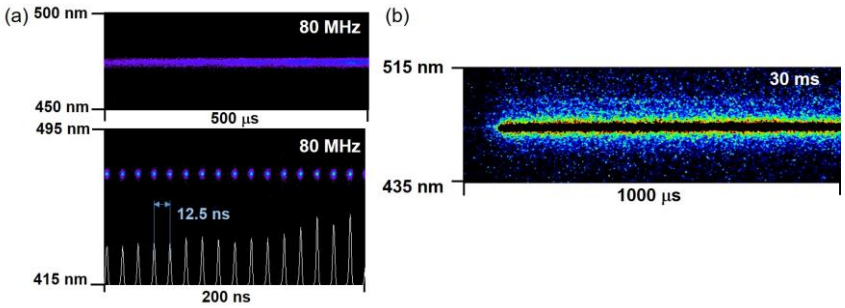


**Fig. 1.** Streak camera images of (a) quasi-CW laser emission at a repetition rate of 80 MHz [(top) 500 μs and (bottom) 200 ns time scales] and (b) true-CW laser emission under 30 ms of long photoexcitation. Individual emission signal can be identified in a short time scale [bottom one of (a)] while it is not possible to identify them in a long time scale [top one of (a)].

1. T. Aimono, et al., *Appl. Phys. Lett.* 2005, ***86***, 071110.
2. A. S. D. Sandanayaka, et al., *Adv. Opt. Mater.* 2016, ***4***, 834.