

有機半導体レーザ：レーザ発振と ASE

Organic semiconductor lasers: Laser oscillation and ASE

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Laser is an electronic device that can be composed of a laser medium (a light emitting material) and a resonator (a gain medium with an optical feedback system). In the case of OSCLs, two types of feedback systems can generally be considered, one being a Fabry-Pérot resonator (FPR) and the other being a distributed feedback (DFB) construction. We fabricated an el-OSCL with FET structure using the DFB nano construction. The laser emission with extremely narrow spectrum linewidth (FWHM, full width half maximum) can experimentally be detected, which can easily be differentiated from other emissions to provide the firm evidence of whether laser is realized. We observed both a very sharp laser emission spectrum to the resolution limit of an employed detector and a nonlinear increase in emission intensity with the clear J_{th} . The important discussion to be made is whether the real lasing takes place by stimulated amplification of light via a repeated optical feedback process in our el-OSCLs. Lasing is a special physical phenomenon, which can be realized when light emits with sufficiently high intensity, accumulated, and resonantly intensified in a multiple coherent process by stimulated emission in a gain medium of light between the two reflectors so called as a resonator. One of the most confusing events with lasing is amplified spontaneous emission (ASE), where spontaneously emitted photons are coherently amplified in a single stimulated emission process inside a gain medium, and similar properties to those of lasing can frequently be acquired in ASE. The intrinsic dissimilarities between lasing and ASE are whether light amplification is made by a single coherent process (ASE) or a multiple coherent process (LASER) via a feedback process inside a lasing medium, the latter of which can be proven under the existence of a resonator with two opposite reflection mirrors (Fabry-Pérot resonator: FRP) or distributed feedback (DFB) via the Bragg reflections in the periodic nano structure. Consequently, LASER or ASE can be justified by the evidence of the repeated multiple feedback process in a resonator. We will discuss how the oscillated emission realized in our light-emitting device with FET structure can be differentiated between LASER and ASE based on our experiments.