# Formation of a random laser using submicrometer sized zinc oxide spheres

## New application technology using submicrometer sized spheres

We experimentally examined our proposed structure for realizing the control of resonant and lasing properties even in random structures, which was composed of size-mono-dispersive scatterers and intentionally introduced defect regions. In the experiments, we intentionally introduced polymer nanoparticles as point defects into a zinc oxide film composed of mono-dispersive submicrometer spherical particles obtained by laser melting in liquid. We succeeded in the following: drastically improved lasing properties at the defect region compared with those of typical random lasers, suppression of the number of lasing modes, decrease in the thresholds, and limiting the lasing position at the defect. These results suggest the possibility that we can realize single-mode random lasers with well-controlled modal properties even in random structures.

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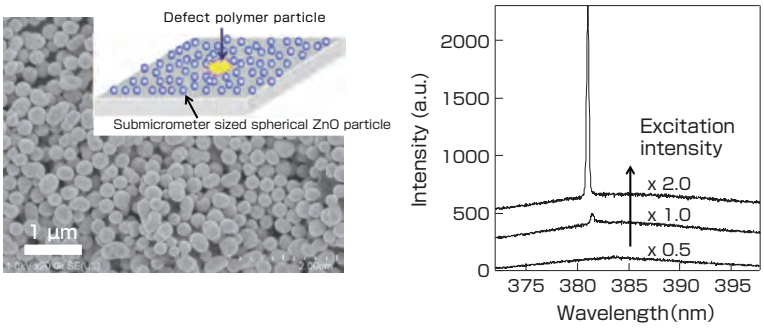
AIST TODAY Vol.13 No.8 p.13 (2013)




**Left: SEM image of thin film consisting of submicrometer spherical ZnO particles**
Inset is outline drawing of random laser device using the ZnO particles.
**Right: Emission spectra measured at a defect site**
The excitation intensities were 0.5, 1.0, and 2.0 times of threshold from bottom to top.



# Improvement of metal/plastic adhesion by photo-irradiation

## New patterning method for fine metal patterns

We have developed a method for the improvement of metal/plastic adhesion by simple photo-irradiation over metal film formed by electroless plating (ELP). An ELP film coated on a plastic substrate is irradiated with high-intensity pulsed light for a very short time (several hundred microseconds), which causes instantaneous heating of the metal film to a high temperature. As a result, only the interface between the ELP film and the plastic substrate can be heated, thus increasing the adhesion without the damage of the substrate. This method allows us to work with large (over A4-size) metal films in a very short time (order of microseconds). This method also provides a simple metal patterning technique. The irradiation of the pulsed light through a photo mask allows us to produce metal patterns on plastic films. That is, the masked region remains poor in adhesion and can be easily peeled off with adhesive tape.

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AIST TODAY Vol.13 No.9 p.14 (2013)

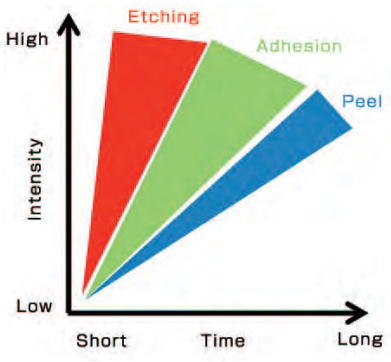


**Photo-irradiation condition (intensity and time) for etching, adhesion and peeling of ELP films**


**Gold film pattern prepared on PET film (top) by the photo-irradiation over a photomask (bottom)**