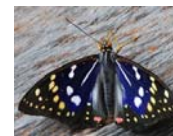


## Purple and ultraviolet arts –To the Millennium of ‘*The Tale of Genji*’ written by *Murasaki-Shikibu*–



*Murasaki Shikibu*

*Oh-murasaki*

J. Matějková-Plsková<sup>1</sup>, S. Shiojiri<sup>2</sup>, M.J. Chen<sup>3</sup>, J.R. Yang<sup>3</sup> and M. Shiojiri<sup>4</sup>

<sup>1</sup>*Instit. of Scientific Instruments, ASCR v.v.i., Královopolská 147, 612 64 Brno, Czech Republic*

<sup>2</sup>*Karasuma Junior High-school, Kyoto 602-0898, Japan*

<sup>3</sup>*Depart. of Materials Sci. and Engineer., National Taiwan University, Republic of China*

<sup>4</sup>*Professor Emeritus of Kyoto Institute of Technology and honorary member of PTMi, 1-297 Wakiyama, Kyoto 616-0091, Japan; e-mail: shiojiri@pc4. so-net. Ne.jp*

*The Tale of Genji*, called the world first romantic novel, was written by the Japanese noble woman **Murasaki Shikibu** (ca 973-1014). From her diary we know that *The Tale of Genji* first caused a sensation among the imperial court. It was on November 1st, 1008. Her name came from the heroin's name, **Lady Murasaki**, of *The Tale of Genji*. **Murasaki** is the Japanese word for the colour purple or violet, which is colour of purple gromwell, wisteria blossom, or flower of paulownia (tree). Here, we present two topics, related with **murasaki**; 1) The fine structures of wing scales in *Sasakia charonda* butterfly as a photonic crystals and 2) ZnO-based **ultra-violet** light emitting diodes fabricated using atomic layer deposition technique.

1) *S. charonda*, Japanese national butterfly, is called ‘the Great purple emperor’ in English and ‘**Oh-murasaki**’ in Japanese. Matějková, Shiojiri and Shiojiri have investigated the microstructure of scales in the male wings by FE-SEM, and identified six types of scales; B1, W1, and R1 in brown background, yellow spots, and red spots, respectively, B2 in iridescent purple-blue and W2 in white pearl, both of which characterise the male, and B3 in the wing edges. The B1, W1, and R1 scales are almost the same in structure, and the B2 and W2 scales are almost the same. Bs have melanin, Ws have less melanin, and R has some pigment, The B1, W1, and R1 scales have only two layers of cuticle lapped on the ridges, while the B2 and W2 scales have seven multilayers of cuticle piled on the ridge. The multiple interference of light that occurs among these cuticle layers generates the significant iridescence of the B2 and W2 scales. B3 has a characteristic shape and structure without multilayers of cuticle on the ridges in the scales, which may function to eject rainwater from the wings.

2) Recently, we (Chen, Yang, M. Shiojiri and collaborators) have been investigating ZnO-based light-emitting diodes (LEDs) which are fabricated using atomic layer deposition (ALD) to growth of the epilayers. At first, we explain the ALD technique and then review two examples from a series of our works; i) ultraviolet (UV) electroluminescence (EL) from *n*-ZnO/*p*-GaN:Mg heterojunction LEDs and ii) UV EL from *n*-ZnO:Al/ZnO-SiO<sub>2</sub> nanocomposite/*p*-GaN:Mg LED. Since it is still difficult to produce reliable and high-quality *p*-type ZnO with high carrier concentration, *p*-GaN layers are used in heterojunction LEDs. Generally, the EL originates from the *p*-GaN side in the *n*-ZnO/*p*-GaN LEDs, because the electron injection from *n*-ZnO would prevail over the hole injection from *p*-GaN. In these experiments, we have succeeded in achieving the significant UV emission from the *n*-ZnO side by using crystalline undoped *n*-ZnO layers grown by ALD and rapid annealing treatment i) or by placing the ZnO-SiO<sub>2</sub> nanocomposite grown by ALD as a current blocking layer ii). The negligible defect-related bands in the EL and PL spectra and the significant UV emission from ZnO at low injection currents reveal that the ALD technique is applicable to deposit high-quality epilayers such as ZnO and ZnO-SiO<sub>2</sub> for next-generation UV LEDs and lasers. These UV devices would be used to various fields such as medicine, biochemistry, white light generation, light source of optical recording, *etc.*