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ZnO nanorod and nanoneedle prepared by direct current magnetron sputtering

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In this study, we report the zinc oxide nanorod and nanoneedle growth on glass substrates by direct current magnetron sputtering, which has not been reported before to the best of our knowledge. The zinc oxide nanorods and nanoneedles are irregularly angled, having many branches at low oxygen flow. The effect of zinc oxide nano crystallization on the photoluminescence (PL) is a great increase in visible luminescence. Room-temperature photoluminescence property was enhanced to 100 times by the growth of nanorod. We controlled oxygen flow in direct magnetron sputtering process. X-ray diffraction pattern shows the polycrystalline structure only at low oxygen flow. Peak intensity of the zinc oxide films were increased by annealing process in argon gas. Based on the experimental observation, we suggest that the high visible luminescence property of zinc oxide nanorod prepared by direct current magnetron sputtering can be applied for various optical devices.

Keywords: ZnO, nanorod, photoluminescence,DC magnetron sputtering

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Fracture detection of concrete structures by electrically conductive GFRP composites

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It is very importance to ensure the safety of large civil structures such as bridegs, roads and tunnels, particularly if they have sufered damage from natural disasters or serious accidents. For examole, after the Hasin-Kobe earthquake of 1995 in Japan, the safety of many of the structures left standing was in doubt. There is increasing demand for a new reliable technique to evaluate quantitatively the degree of internal damage in structures like buildings and bridges, or of damage in underground constructions like building foundations and tunnels. A new type of composites has been developed to perform in-site diagnosis, that is, health monitoring and fracture detection, in structures. The aim of this study is to determine if the composite is useful for measuring damage and fracture in concrete blocks and piles. We chose to test the technique in concrete because it is typically different to observe damage or fracture in concrete structures that are in use.

The function and performance of self-diagnosis composites embedded in concrete blocks and piles were investigated by bending tests and electrical resistance measurement. Carbon powder (CP) and carbon fiber (CP) were introduced into glass fiber reinforced plastic (GFRP) composites to provide electrical conductivity. The CPGFRP composite displays good performance in various bending tests of concrete block and piles compared to the CFGFRP composite. The electrical resistance of the CPGFRP composite increases remarkably at small strains in response to microcrack formation at about 200 um strain, and can be used to detect smaller deformation before crack formation. The CPGFRP composite shows continuous change in resistance up to a large strain just before the final fracture for concrete structures reinforced by steel bars. It is concluded that self-diagnosis composites can be used to predict damage and fracture in concrete blocks and piles.

Keywords: Fracture detection, GFRP composites, carbon powder, electrical resistance, concrete structure