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Enhanced photocatalytic activity of metallic oxide nanostructures synthesized by a plasma afterglow-assisted oxidation process.

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Metallic oxide nanostructures are promising materials in photocatalysis applications, for example in water treatment and disinfection or for hydrogen production by water splitting. Growing metallic oxide nanostructures can be achieved by simple thermal oxidation of raw metallic materials. The use of direct plasma treatments increases the growth rate of nanostructures by several orders of magnitude whereas remote plasma treatments improve the control of the design of nanostructures by moving the temperature window where nanostructures are formed by about 100 K downward. This shift enables the development of higher stress levels and offers the possibility to create dense areas of nanostructures [1]. For a given nanostructure, it is even possible to design them by driving growth instabilities using mixtures of metals [2]. We can thus expect to control the growth of ultrathin nanowires where quantum confinement is possible. For instance, the synthesis of ultrathin, single-crystalline zinc oxide nanowires was achieved by treating in a flowing microwave plasma oxidation process zinc films coated beforehand by a sputtered thin buffer layer of copper [3]. An average diameter of 5 nm correlated with a mean length of 750 nm can be reached with a fairly high surface number density for very short treatments, typically less than 1 minute. An enhancement of photocatalytic activity and photocurrent intensity under visible and UV light is observed for ultrathin nanowires, attributed to high separation efficiency of photoinduced electron-hole pairs.

References

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Keywords

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