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Controlling electric fields spatially by graded metamaterials[1] KIN-WAH YU, Chinese University of Hong Kong — The local electric field of a metal-dielectric composite cylinder, whose complex permittivity is given by a spatially dependent Drude model, has been derived analytically in terms of hypergeometric functions. Our results show that the electric field inside the cylinder can be confined to any desired position. Thus one can achieve the control of electric fields by fabricating graded metamaterials with specific material parameters. The enhanced nonlinear optical response of the composite cylinder has also been calculated [1]. The results suggest that the gradation-controlled electric field distribution may be a consequence of a combination of surface plasmon resonance and the microgeometry in graded metamaterials. Moreover, such a gradation-controlled field distribution serves as a physical mechanism for understanding the enhanced nonlinear optical responses with a broad surface plasmon band [2].

[1] J. P. Huang and K. W. Yu, Phys. Rep. **431**, 87 (2006).
[2] J. P. Huang and K. W. Yu, Appl. Phys. Lett. **85**, 94 (2004).

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