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**High-efficiency visible photocatalytic degradation of methyl orange by silicon nanoporous pillar array**

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**Abstract:** In this paper, we report that a silicon hierarchical structure, silicon nanoporous pillar array (Si-NPA), was prepared and its visible photocatalytic properties were studied by selecting methyl orange (MO) as the target substance. It was shown that a broadband visible light absorption beyond 96% was reached and a one-hour degradation of 97.7% was achieved under optimized conditions. The excellent photocatalytic property of Si-NPA was attributed to the enlarged bandgap brought by quantum confinement effect and the unique surface morphology and microstructure of Si-NPA. Our experiments might have put forward a promising route for fabricating Si-based photocatalyst to degrade organic pollutants in water.

**Key words:** Semiconductors; Silicon nanoporous pillar array (Si-NPA); Porous materials; Visible photocatalysis; Organic pollutants

## 1 Introduction

Titanium dioxide (TiO<sub>2</sub>) has been widely studied as a photocatalyst in the past decades, and much promising progress has been made owing to its high photocatalytic activity and corrosion stability [1, 2]. However, the large bandgap of TiO<sub>2</sub> (~3.2 eV) determines that the active electrons/holes needed for

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