Supplementary information

Experimental Section

The overall fabrication procedure is presented as follows: tin powder (99.8%, <45μm), purchased from Sigma-Aldrich Co., was dispersed in a cuvette full of ethanol. When most particles sank down, supernatant fluid containing finer particles was transferred onto the Si wafer using burette. The tin particles remained on the wafer after the ethanol was dried. Then the wafer was located in the central zone of a horizontal alumina tube in a tube furnace. The furnace was vacuumized to 100Pa and then the pressure of the tube was kept at 20000Pa using Ar gas. The furnace was heated to 900°C at a rate of 100 degree per minute. When the temperature reached 900°C, the furnace was re-vacuumized to 100Pa and sealed, and held for 4h. Then the furnace was cooled to room temperature.

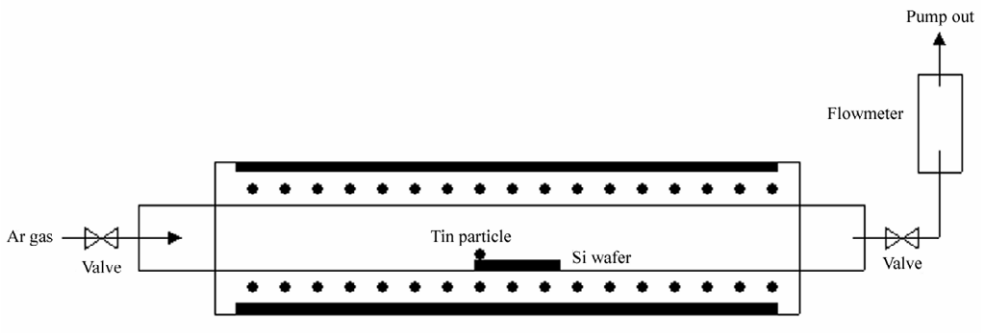

Fig. S1 Schematic diagram of experimental setup

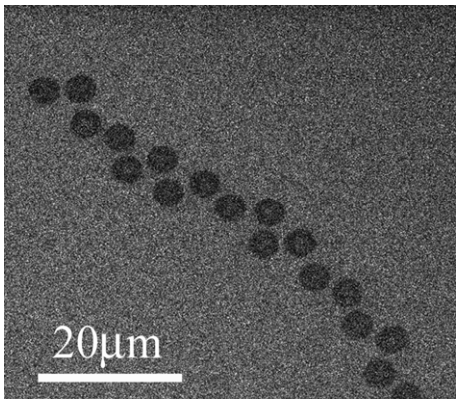

Fig. S2 SEM image of Si wafer after the silicon nanowires array was removed: the disk-like dent in the form of Karman vortex street is a proof that silicon nanowires were grown from the wafer.

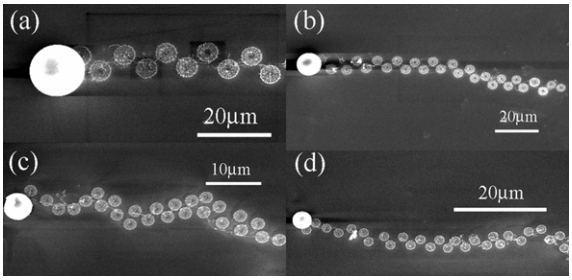

Fig. S3 SEM images of Karman vortex street, revealing tunable array with various diameter of tin particle: the diameter ratio of disks to Sn particle is 0.42 ± 0.07 and the ratio of distance between two adjacent disks to Sn particle's diameter is 0.53 ± 0.02.

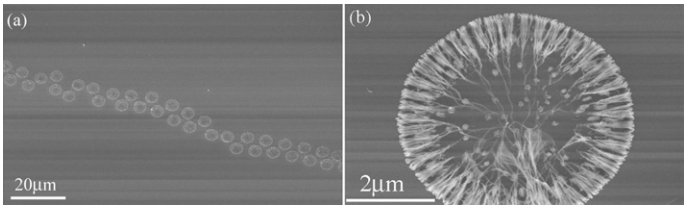

Fig. S4. SEM images of products at the reaction time of 0.5h: (a) silicon nanowires array; (b) single silicon nanowire disk with the diameter of 5.4μm. Tin balls in the center of disk are clearly seen. The silicon nanowires connected disks were not grown up.

Calculation of Reynolds number

1. Density of Ar gas:

$$\rho = \frac{pM}{RT} = \frac{20000 \times 40 \times 10^{-3}}{8.314 \times (900 + 273.2)} = 0.082 kg/m^3$$

2. Viscosity of Ar gas (Hirschfelder method) [S1]:

$$\mu = \frac{33.3 \times 10^{-4} (MT_C)^{0.5}}{V_C^{\frac{2}{3}}} [f(1.33T_r)]$$

Where μ, M, T_C, V_C are viscosity, molecular weight, critical temperature and critical volume of Ar gas with the units of cP, g/mol, K and cm^3/mol, respectively;

$Tr = \frac{T}{T_C}$ is the reduced temperature; and $f(1.33T_r) = 1.058T_r^{0.645} - \frac{0.261}{(1.9T_r)^{0.9\lg(1.9T_r)}}$

M, T_C, V_C of Ar gas are 40g/mole, 150.8K and 74.9cm^3/mole, respectively, and

$$Tr = \frac{T}{T_C} = \frac{900 + 273.2}{150.8} = 7.78$$

$$f(1.33T_r) = 1.058T_r^{0.645} - \frac{0.261}{(1.9T_r)^{0.9\lg(1.9T_r)}} = 1.058 \times (7.78)^{0.645} - \frac{0.261}{(1.9 \times 7.78)^{0.9\lg(1.9 \times 7.78)}}$$

=3.972

$$\mu = \frac{33.3 \times 10^{-4} (MT_C)^{0.5}}{V_C^{\frac{2}{3}}} [f(1.33T_r)]$$

$$= \frac{33.3 \times 10^{-4} (40 \times 150.8)^{0.5}}{74.9^{\frac{2}{3}}} \times 3.972 = 5.78 \times 10^{-2} \text{cP} = 5.78 \times 10^{-5} \text{Pas}$$

3. Calculation of Reynolds number

$$\text{Re} = \frac{\rho u_0 d}{\mu} = \frac{0.082 \times 1 \times 15 \times 10^{-6}}{5.78^{-5}} = 0.02$$

Reference

[S1] R. H. Perry and C. H. Chilton, *Chemical Engineers' Handbook.* 5th ed., McGraw-Hill, New York, 1973. Section III, pp247~249.