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Partial pressure-induced growth of silicon nitride belts with tunable width and photoluminescence property

J. Cai,[a] Y. L. Zhang,[a] Z. Y. Lyu,[a] J. Zhao,[a] J. C. Shen,[b] Q. Wu,[a] X. Z. Wang,*[a] X. L. Wu,*[b] Y. Chen[a] and Z. Hu[a]

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SI-1 The ratios of β- and α-Si_3N_4 vs. partial pressure of NH_3/N_2 in Ar-NH_3/N_2 flow

The ratios of β- and α-Si_3N_4 at different ratios of P(NH_3/N_2) and P(Ar) are calculated by commercial software of Jade 6.0 shown in Fig. S1, following Fig. 1.

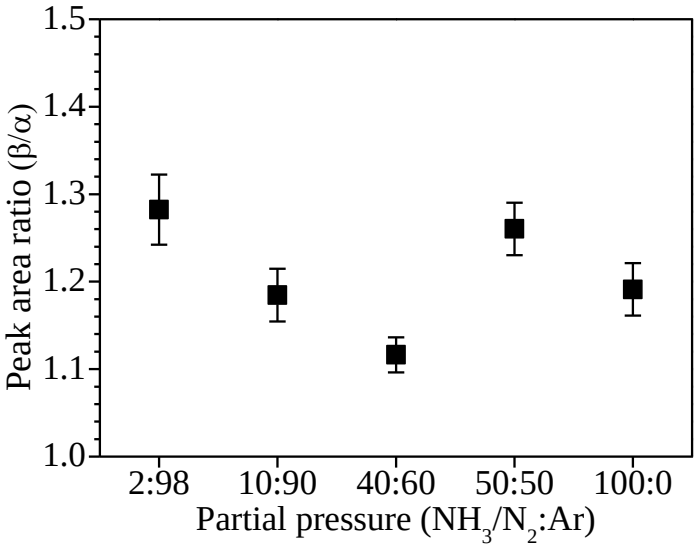

Fig. S1 The relationship of the ratios of β-and α-Si_3N_4 and partial pressure of NH_3/N_2 in Ar-NH_3/N_2 flow. P(NH_3/N_2):P(Ar)=100:0, 50:50, 40:60, 10:90, 2:98.

SI-2 Low-magnification SEM images of the products at different ratios of P(NH_3/N_2) and P(Ar)

Low-magnification SEM images of all products indicates that the distributions of Si_3N_4 belts are uniform at P(NH_3/N_2):P(Ar)=100:0, 50:50, 40:60, 10:90, 2:98 (Fig. S2a-f). While the silicon powders were treated in pure Ar flow (P(NH_3/N_2):P(Ar)=0:100), no wire-like or belt-like morphologies can be observed.

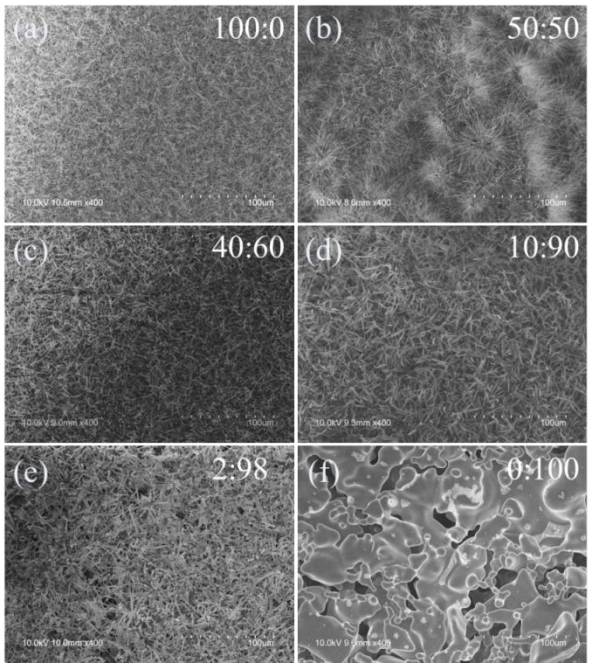

Fig. S2 Low-magnification SEM images of the products at P(NH_3/N_2):P(Ar)=100:0, 50:50, 40:60, 10:90, 2:98, 0:100.

SI-3 EDS analysis and elemental mapping images of Si and N from a single Si_3N_4 belt

EDS result clearly indicates that the nitridation products are composed of Si and N elements (Fig.S3a). In comparison with the SEM and mapping images of a single Si_3N_4 belt, the dispersions of Si (Fig.S3c) and N (Fig.S3d) elements keep almost the same as the SEM image (Fig.S3b) in detail, further indicated that the belt is composed of Si and N elements.

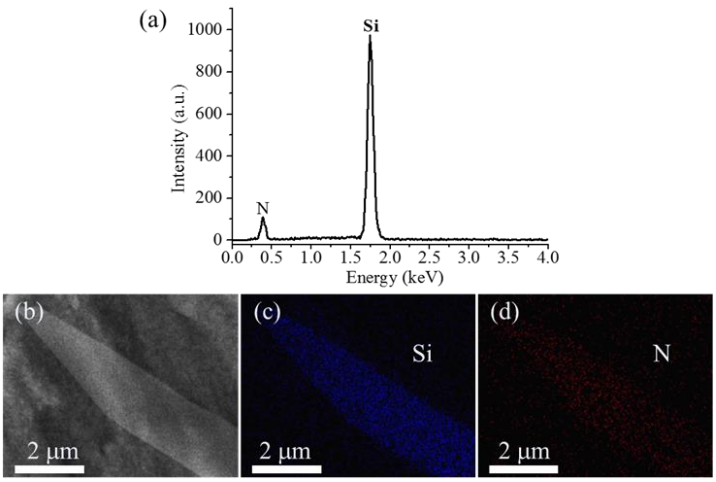

Fig. S3 EDS analysis (a) and elemental mapping images of Si and N from a single Si_3N_4 belt (b-d).

SI-4 SEM images and the width distribution of the nitridation products at different temperatures and designated P(Ar) (P(NH_3/N_2):P(Ar)=50:50

The influences of the growth temperature on the width of Si_3N_4 belts are also investigated. SEM images of the nitridation products at 1300, 1350, 1400 ºC and P (NH_3/N_2):P (Ar)=50:50 are shown in Fig. 2a,b,d,e,g,h. The average width of the belts are 270, 289, 345 nm, respectively, which can be slightly modulated by the nitridation temperature.

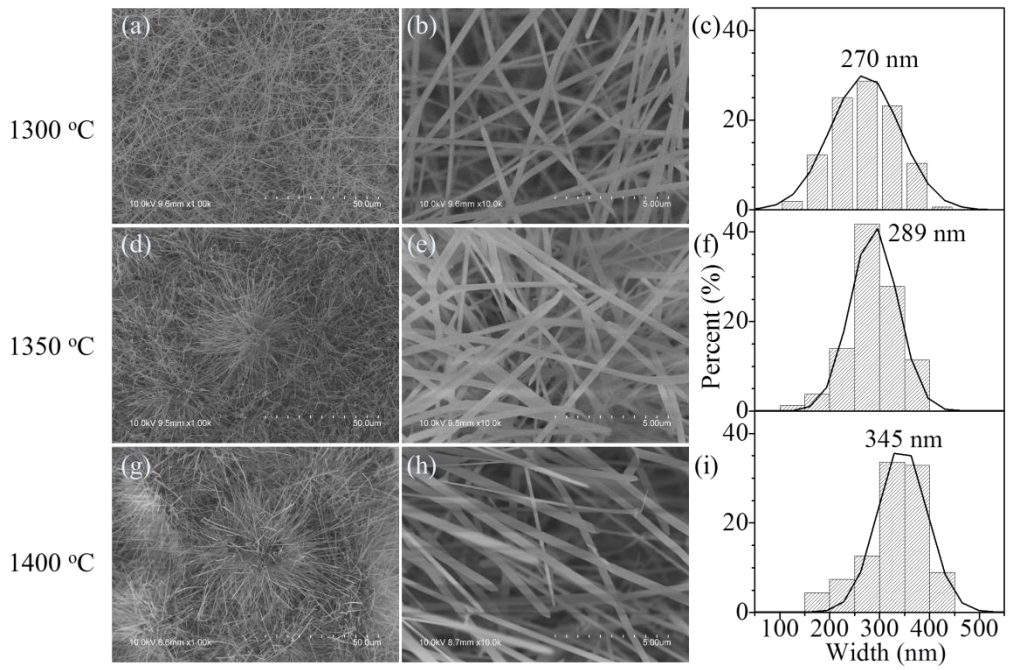

Fig. S4 SEM images and width distributions of the nitridation products at 1300, 1350 and 1400 ºC and P(NH_3/N_2):P(Ar)=50:50.

SI-5 Enlargement of PL spectra in Fig.5

To clearly exhibit the near UV-blue emission bands, Fig.5 is enlarged. As shown in Fig.S5, all five Si_3N_4 samples emit the near UV-blue light.

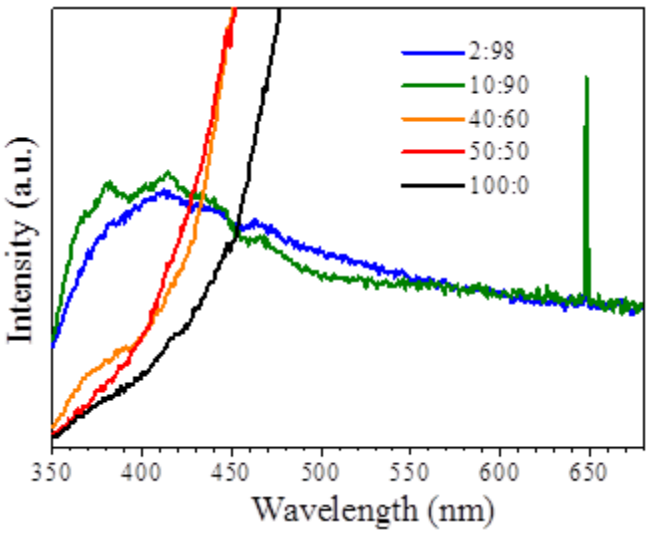

Fig. S5 Enlargement of the PL spectra in Fig 5. The sharp peaks near 650 nm come from the multiplication frequency of 325 nm excitation.