

Supplementary Information

Gallium Nitride Formation in Liquid Metal

Sonication

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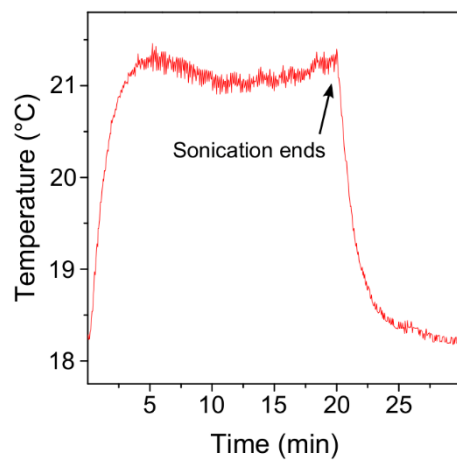


Fig. S1 Thermal profile of the sonication process of LM-PVP-N₂.

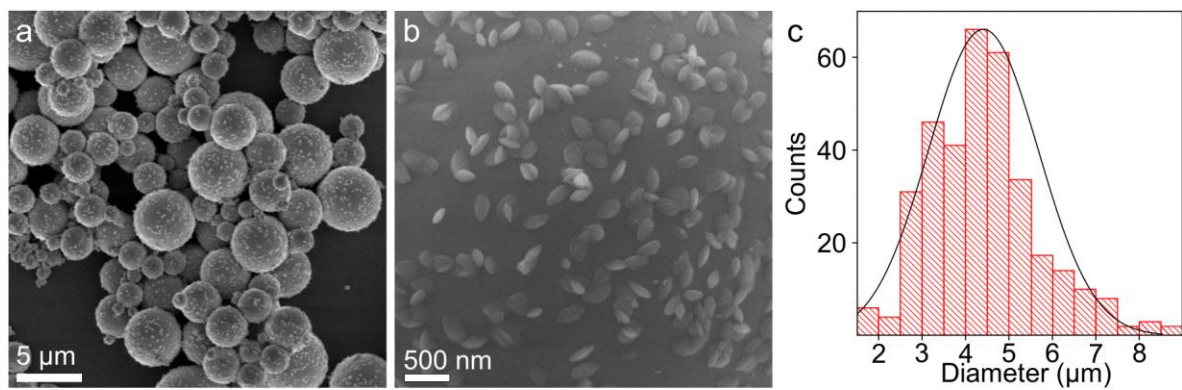


Fig. S2 (a) SEM images of spherical particles obtained from EGaIn sonicated in DI water without surfactant or N_2 bubbling. (b) Secondary features on the surface of spherical particles in (a). (c) Diameter distribution of the particles obtained in (a).

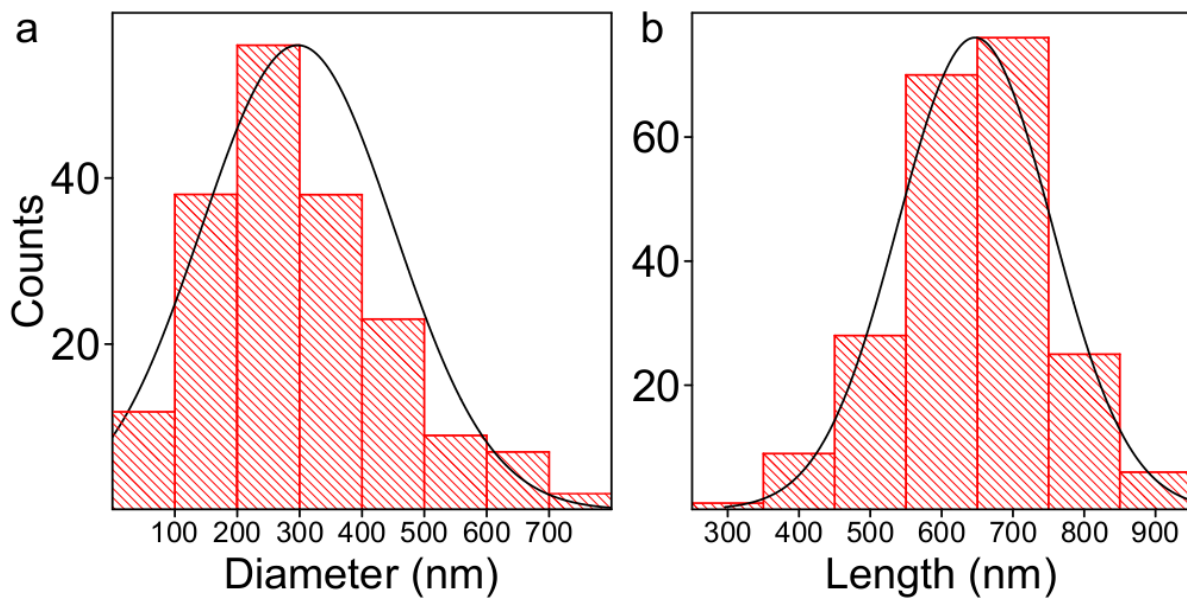


Fig. S3 Average size of the output when the liquid metal is sonicated with PVP with (a) diameter distribution of spherical particles and (b) length distribution of non-spherical structures.

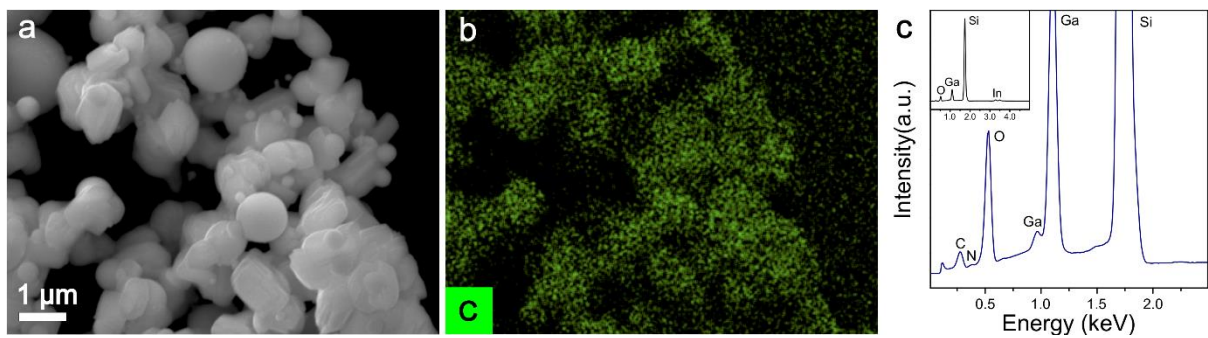


Fig. S4 SEM/EDS analysis of the LM-PVP-N₂ sample. (a) Same selected area as Fig. 1d. (b) Carbon elemental mapping. (c) SEM/EDS spectrum of the selected area in (a).

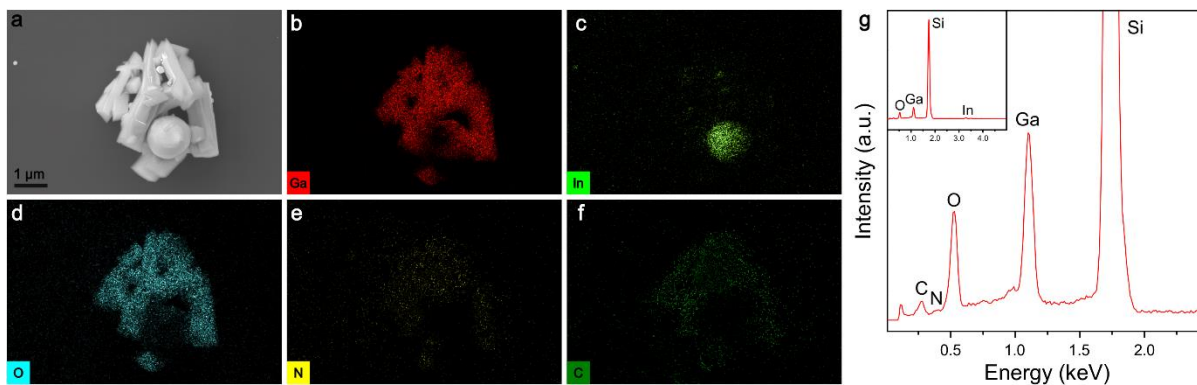


Fig. S5 (a-f) SEM/EDS mapping of selected area of the LM-PVA-N₂ sample with Ga, In, O, N and C elements. (g) SEM/EDS spectrum of the selected area in (a).

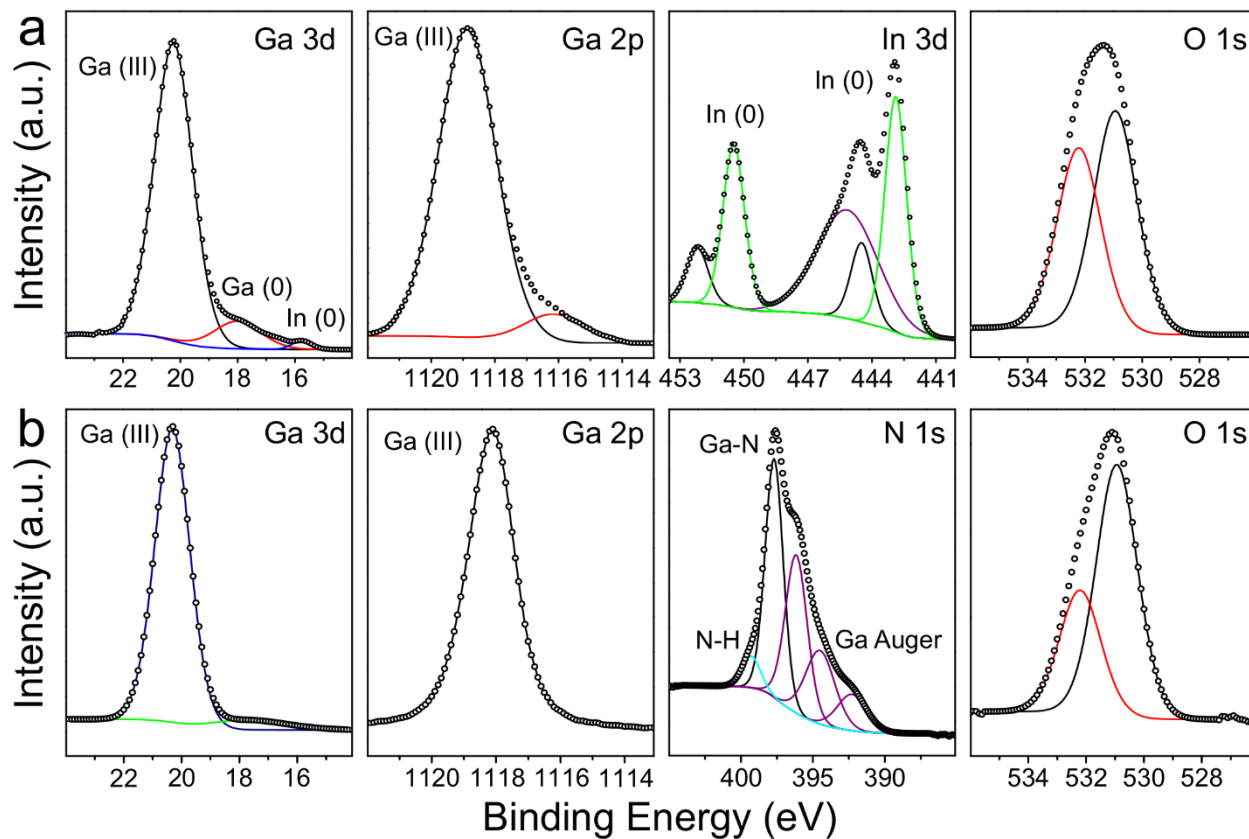


Fig. S6 XPS spectra of (a) EGaIn sonicated in DI water without surfactant or N₂ bubbling in Ga 3d, Ga 2p, In 3d, and O 1s. (b) Commercially obtained GaN powder in Ga 3d, Ga 2p, N 1s, and O 1s.

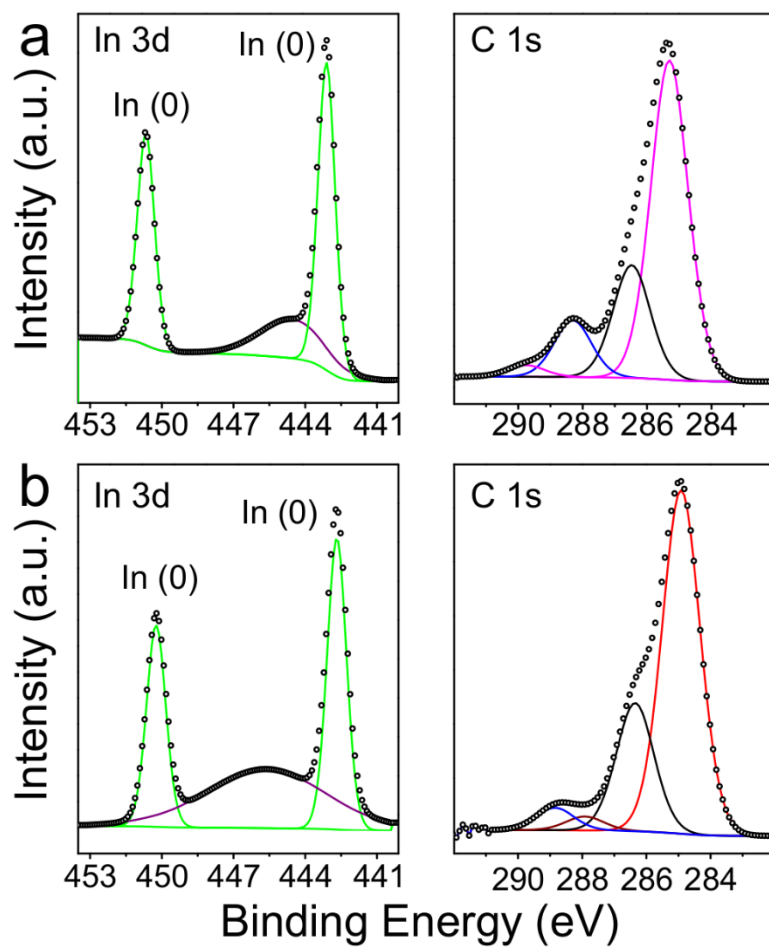


Fig. S7 XPS spectra of In 3d and C 1s of the as-prepared NPs with (a) PVP and (b) PVA.

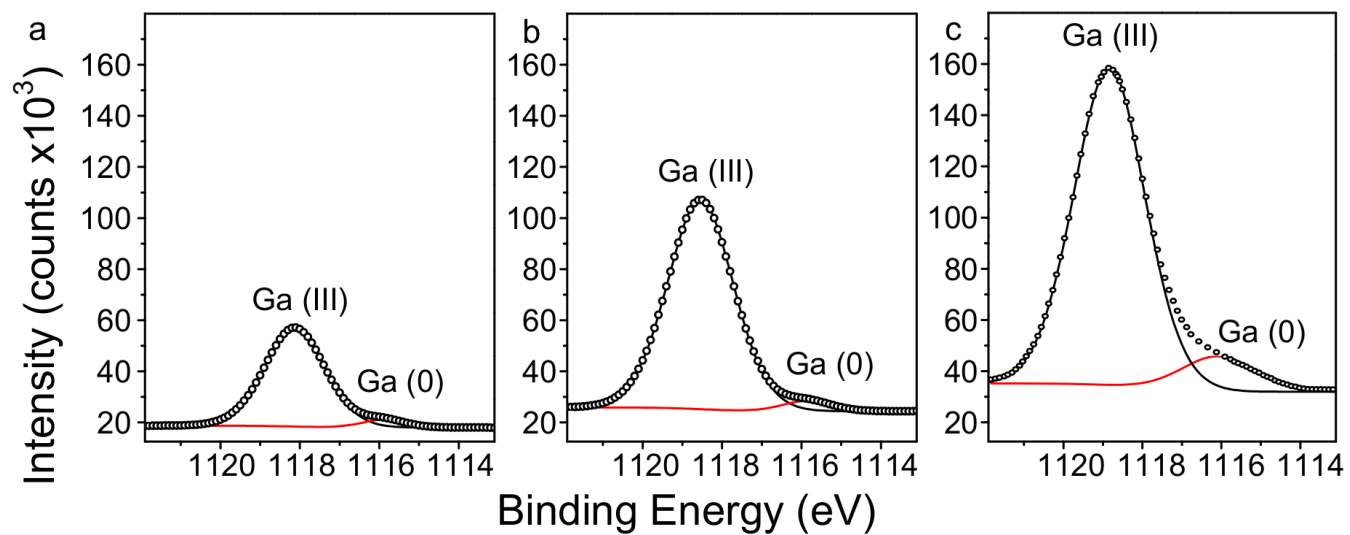


Fig. S8 XPS spectra of Ga 2p without normalisation (a) LM-PVP-N₂, (b) LM-PVA-N₂ and (c) LM-DIW-air sample.

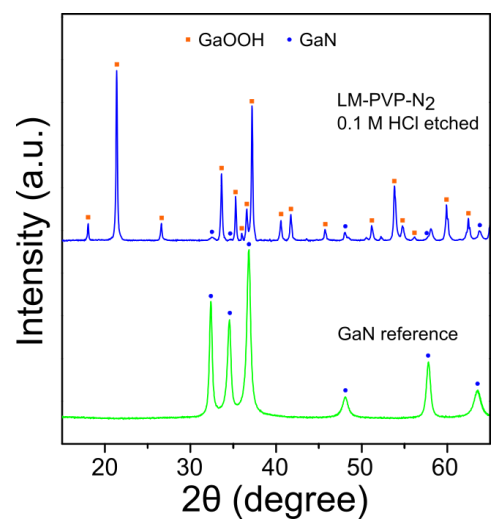


Fig. S9 Full range XRD of the sample presented in Fig. 2d.

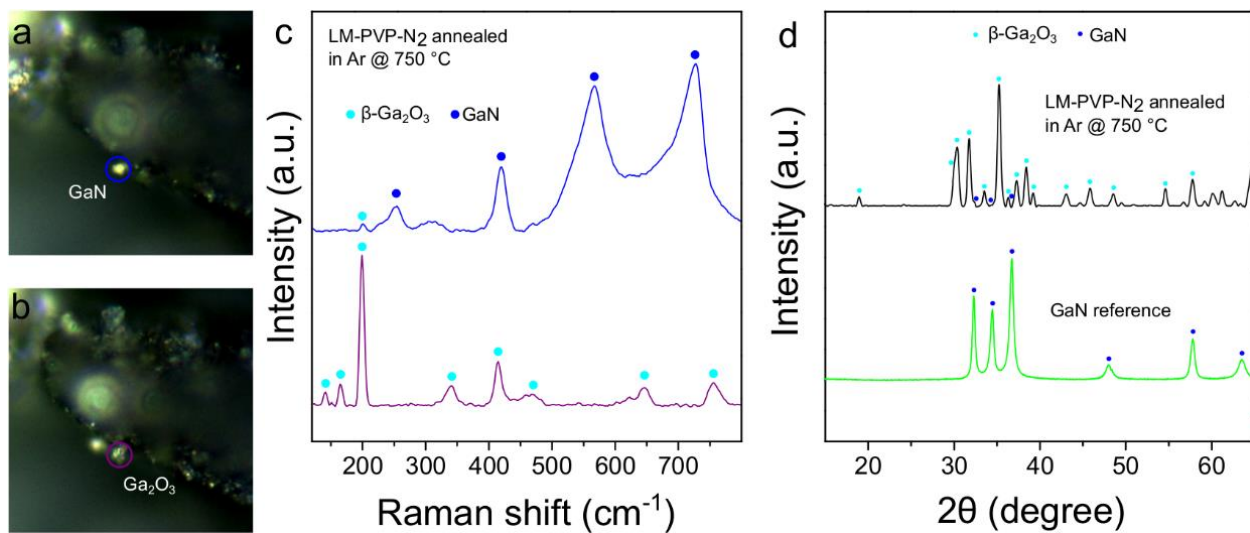


Fig. S10 Characterisations of LM-PVP-N₂ after annealing for 7.0 hr at 750 °C under constant flow of Ar. Locations of the Raman spectra were taken (a) hexagonal GaN (highlighted blue in (c)) and (b) monoclinic β -Ga₂O₃ (highlighted purple in (c)). (c) Raman spectra of the highlighted area. (d) XRD pattern of a reference GaN sample and the LM-PVP-N₂ after annealing.

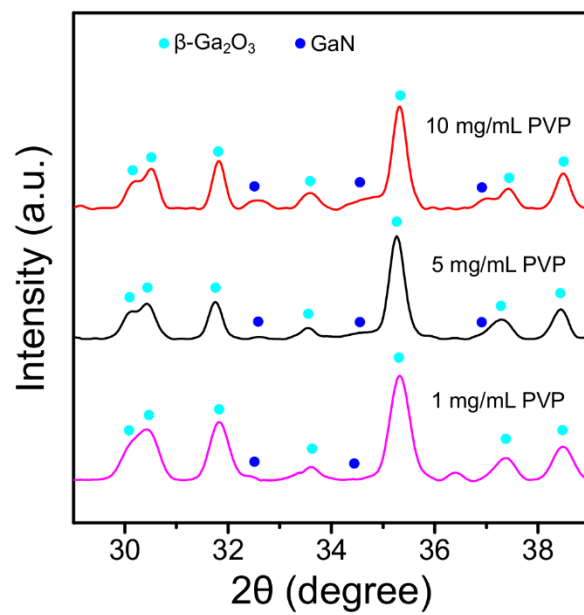


Fig. S11 XRD of the LM-PVP-N₂ sample with different PVP concentrations.

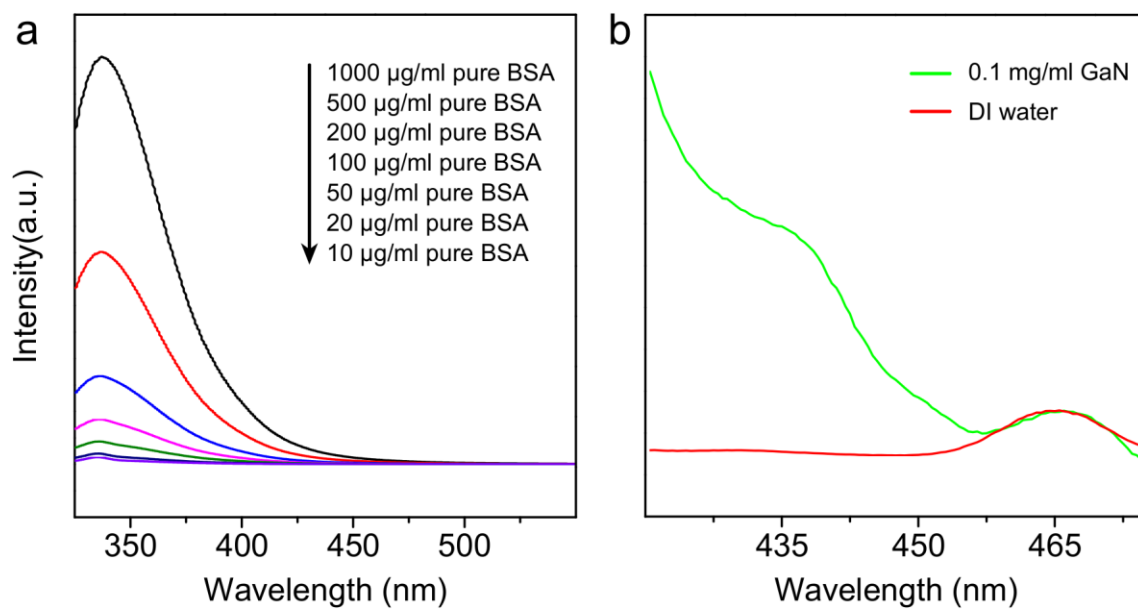


Fig. S12 (a) Photoluminescence of various concentration of pure BSA water, excited at 300 nm. (b) Photoluminescence of 0.1 mg/ml GaN dispersed in DI water by gentle shaking and pure DI water, excited at 400 nm.

Table S1. Atomic percent (at%), XPS peak positions, full width at half maximum (FWHM) and peak attribution of the LM-PVP-N₂.

Name	Position (eV)	FWHM	Atomic %	Attribution
C1s A	285.4	1.65	16.88	PVP
C1s B	286.4	1.65	9.87	
C1s C	288.8	1.65	2.49	
C1s D	288.3	1.65	3.63	
O1s A	530.9	1.92	19.62	GaOOH
O1s B	532.2	1.92	12.51	GaOOH
N1s A	397.4	2.62	17.51	GaN
N1s B	400.2	2.62	7.22	PVP
In3d5 A	443.1	1.52	0.81	Metallic In
In3d5 B	444.5	1.52	0.18	Metallic In
Ga3d A	20.2	2.23	8.34	GaOOH and GaN
Ga3d B	18.0	1.56	0.93	Metallic Ga