Supplementary Information

1. Fitted functions for the three group experiments

$$V_{10} = -26.01\exp(-0.01569t) - 0.8986\exp(-0.1208t) + 26.9 \quad (1)$$

$$V_{20} = -3.778\exp(-45.35t) - 37.26\exp(-0.01545t) + 41.04 \quad (2)$$

$$V_{40} = -14.1\exp(-0.1009t) - 30.16\exp(-0.01693t) + 44.26 \quad (3)$$

2. Measurement of the gallium mass loss

Initially, the mass of Ga in the container is weighted as 1.8g. Then we added 0.2g Al and stirred them until they were well mixed. Afterwards, we poured excess water into the container so that the mixture (including that stuck to the glass rod) reacted well with the water. When the reaction finished, the gallium was separated from the solution by filtration and centrifugation. In order to remove the reaction products stuck to the oxide layer of gallium, the gallium droplet was rapidly cleared with a drop of NaOH solution and a drop of water. Besides, the gallium droplet was placed on a filter paper so that the water on the surface of the gallium droplet was rapidly absorbed. Finally, the dried gallium droplet was weighted as 1.7g. Later, we repeated the experiment using the left gallium. The mass change of gallium was listed in Table S1.

Table S1. Mass loss of the gallium

	Initial value	After the first cyle	After the second cyle	After the third cyle
Mass of the gallium (g)	1.8	1.7	1.67	1.62
Mass loss(g)		0.1	0.03	0.05
Mass loss ratio (%)		5.56	1.76	2.99

The mass loss of the gallium comes from the oxidation during the mixture process. It can be seen that after three cycles, the total loss of mass is 0.18g, which is 7.2% of

the initial weight. The mass reduction is mainly from the washing-away of the oxide by NaOH, and the loss ratio is within an acceptable range.

3. XRD patterns of unfrozen and frozen samples

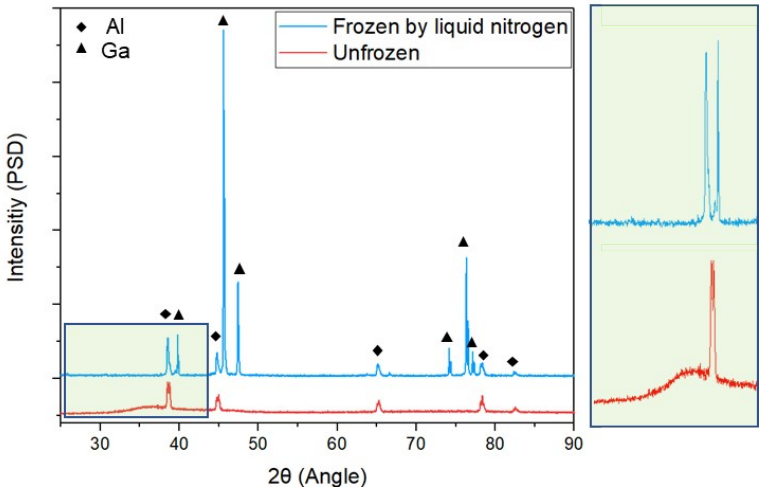

Figure S1. XRD results of unfrozen and frozen samples (Al20Ga80).