

## ***Supplementary Information***

# **Electrochemical Nanoimprint Lithography: When Nanoimprint Lithography Meets Metal Assisted Chemical Etching**

*Jie Zhang, Lin Zhang, Lianhuan Han, Zhao-Wu Tian, Zhong-Qun Tian & Dongping Zhan\**

State Key Laboratory of Physical Chemistry of Solid Surfaces (PCOSS), Collaborative Innovation Center of Chemistry for Energy Materials (iChEM), and Department of Chemistry, College of Chemistry and Chemical Engineering, Xiamen University, Xiamen 361005, China

\*E-mail: dpzhan@xmu.edu.cn

### **Content**

- 1. The fermi level alignment on Pt/n-GaAs/electrolyte 3-phase interface**
- 2. One-step ECNL of various kinds of simple 2.5D-MNS**
- 3. XPS analysis of the residual oxides and platinum on GaAs**
- 4. Optimizing the contact pressure of ECNL**
- 5. Optimizing the temperature of ECNL**
- 6. The electrolytic cell used in ECNL**

1. The fermi level alignment on Pt/n-GaAs/electrolyte 3-phase interface

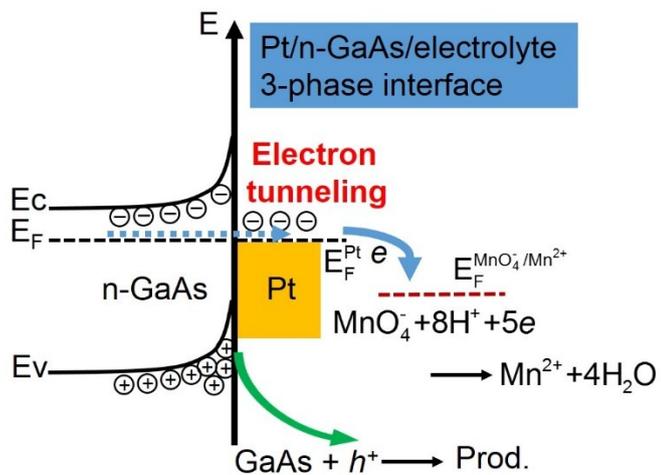
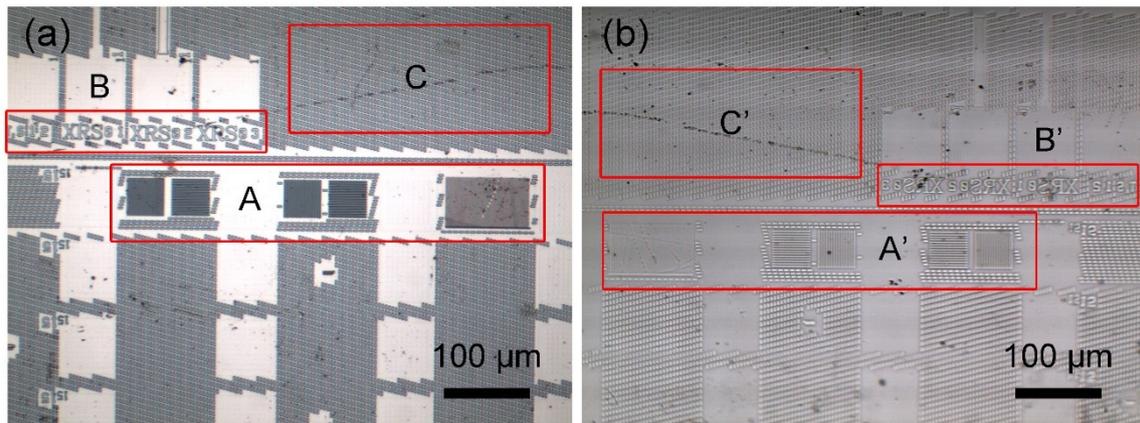


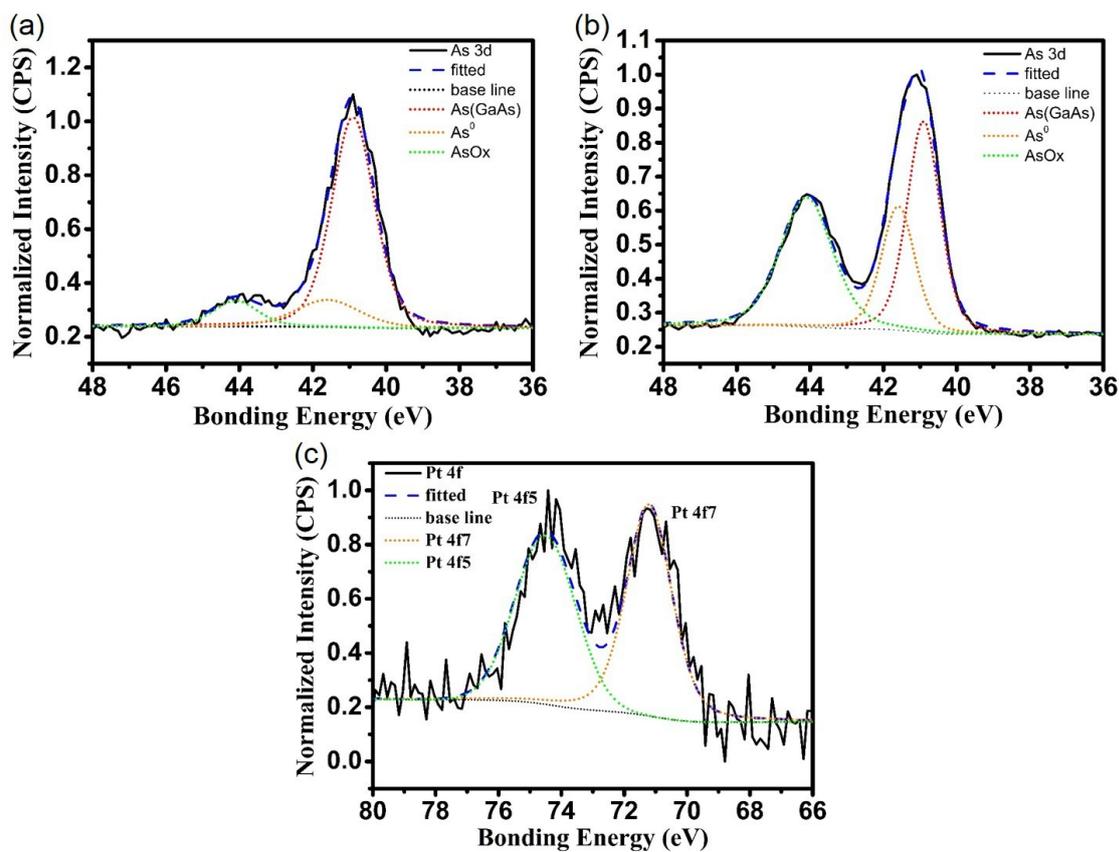
Figure S1. The fermi level alignment on Pt/n-GaAs/electrolyte 3-phase interface.

## 2. One-step ECNL of various kinds of simple 2.5D-MNS



**Figure S2.** The mold (a) with lots of different 2.5D-MNS were imprinted onto n-GaAs (b) with larger area by one-step ECNL for only 20 min. Zone A, B and C on mold were transferred onto n-GaAs with corresponding A', B' and C'.

### 3. XPS analysis of the residual oxides and platinum on GaAs

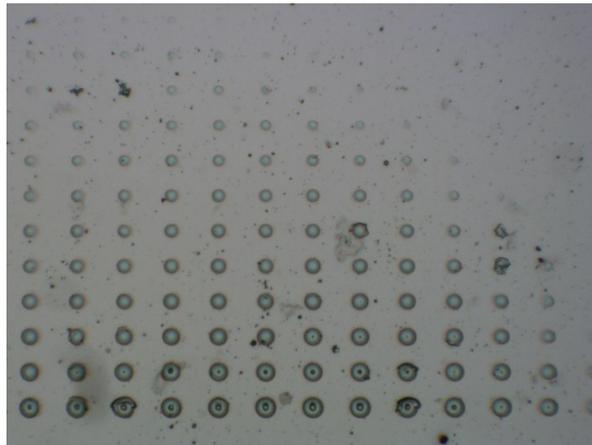


**Figure S3.** The X-ray photoelectron spectra of n-GaAs surface. (a) XPS spectra of As 3d on n-GaAs before ECNL. (b) XPS spectra of As 3d on n-GaAs after ECNL. (c) XPS spectra of Pt 4f on n-GaAs after ECNL.

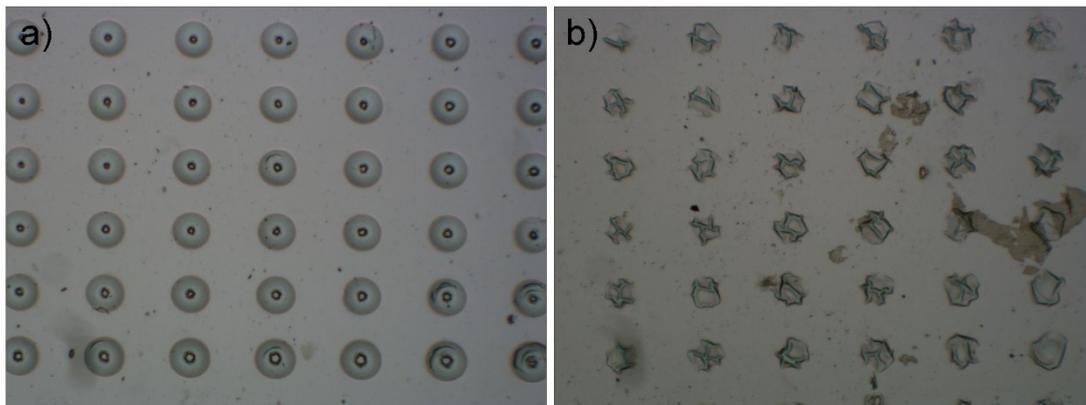
**Table S1** The atomic concentration of the elements on n-GaAs after ECNL

| Sample        | O1s (%) | Ga2p3 (%) | As3d (%) | Pt4f (%) |
|---------------|---------|-----------|----------|----------|
| 1             | 54.23   | 26.05     | 19.43    | 0.29     |
| 2             | 54.99   | 25.08     | 19.81    | 0.12     |
| 3             | 63.69   | 16.79     | 19.32    | 0.20     |
| 4             | 57.95   | 22.93     | 18.63    | 0.49     |
| 5             | 54.29   | 25.25     | 20.11    | 0.35     |
| Average value | 57.03   | 23.22     | 19.46    | 0.29     |

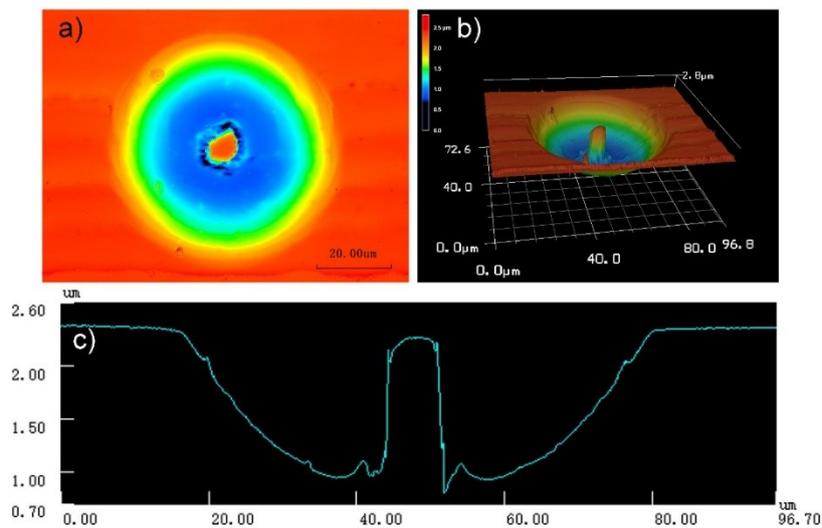
#### 4. Optimizing the contact pressure of ECNL



**Figure S4.** The non-uniform concave microlens fabricated under non-uniform contact pressure. The contact pressure is kept at 0.5 atm.

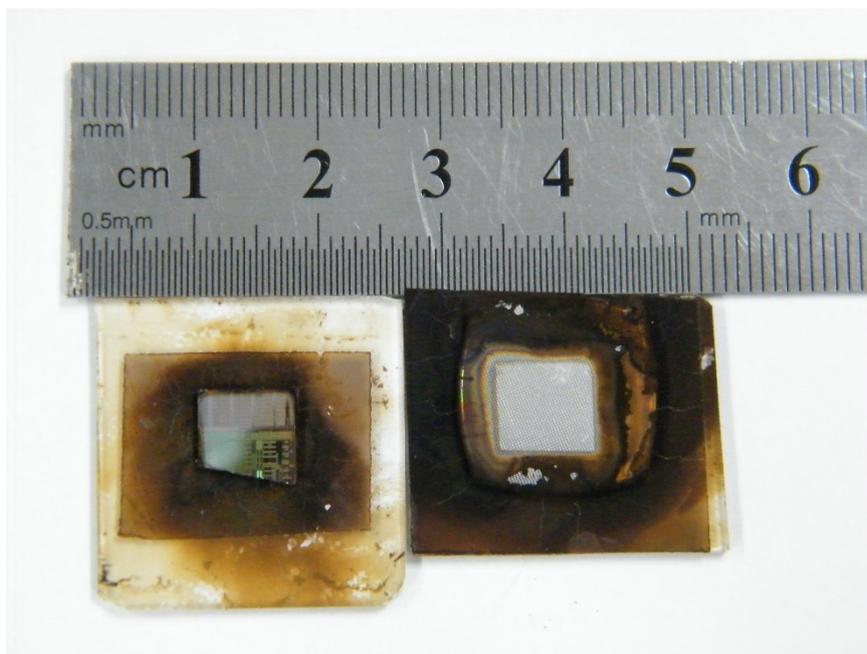


**Figure S5.** The concave microlens with humps (a) and wrinkles (b) fabricated under an excessive contact pressure. The contact pressure is kept at 1 atm (a) and 2 atm (b).



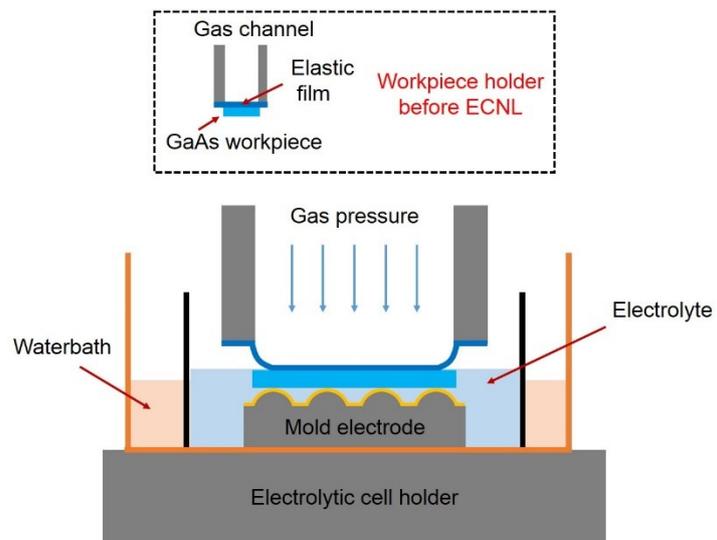
**Figure S6.** The confocal laser microscopy images of concave microlens with humps in the bottom when the contact pressure is kept at 1 atm.

## 5. Optimizing the temperature of ECNL



**Figure S7.** The precipitate of MnO<sub>2</sub> deposited on the surface of mold after ECNL for 40 min when 0.1 mol/L KMnO<sub>4</sub> and 40 °C temperature was used.

## 6. The electrolytic cell used in ECNL



**Figure S8.** The schematic illustration on the electrolytic cell of ECNL.