



HAL
open science

Diamond microelectrode arrays for neuroelectronic interfaces

Mathias Bonnauron, Samuel Saada, Jacques De Sanoit, Lucie Rousseaux, Serge Picaud, Emilie Vanhove, Milos Nesladek, Jean-Charles Arnault, Philippe Bergonzo

► **To cite this version:**

Mathias Bonnauron, Samuel Saada, Jacques De Sanoit, Lucie Rousseaux, Serge Picaud, et al.. Diamond microelectrode arrays for neuroelectronic interfaces. NDNC 2008 - International Conference on New Diamond and Nano Carbon Conference, May 2008, Taipei, Taiwan. <cea-05460455>

HAL Id: cea-05460455

<https://cea.hal.science/cea-05460455v1>

Submitted on 17 Feb 2026

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY 4.0 - Attribution - International License

Diamond Microelectrode Arrays for neuroelectronic interfaces

M. BONNAURON⁽¹⁾, S. SAADA⁽¹⁾, J. DE SANOIT⁽¹⁾, L. ROUSSEAU⁽²⁾, S. PICAUD⁽³⁾, E. VANHOVE⁽¹⁾, M. NESLADEK⁽¹⁾,

J-C ARNAULT⁽¹⁾, P. BERGONZO⁽¹⁾

(1)CEA, LIST, Diamond Sensor Laboratory, CEA/Saclay, Gif-sur-Yvette, 91191 Gif-sur-Yvette France

(2) ESIEE-ESYCOM, Paris, France

(3) CNIC Université de Bordeaux, France

(4) Institut de la Vision, INSERM, Paris, France

Context and Motivation

Diamond : attractive properties for bio-sensing applications :

- Bio-inertness,
- High electrochem stability
- Optical transparency,
- High interests fro neural activity studies.

Challenges :

- Identify novel routes for MEA fabrication
- Avoiding RIE for scalable and ease of process
- Selective nucleation for direct patterning

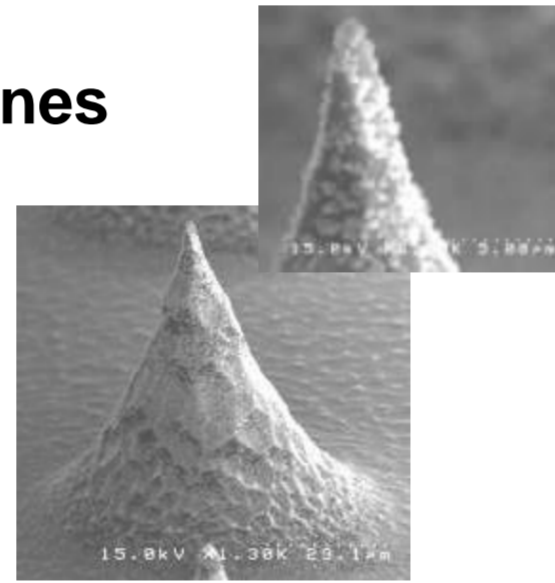
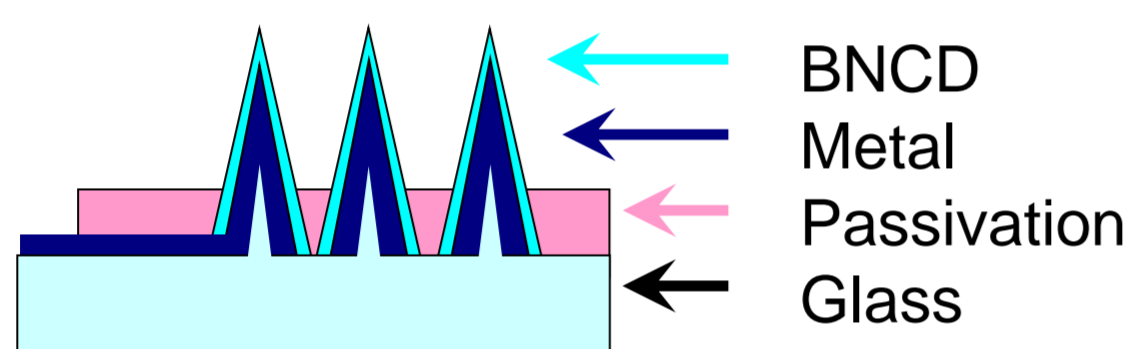
Aims :

- Biocompatibility studies
- 2D and 3D Microelectrode array structures
- up to 256 and towards 600 pixels
- towards spinal chord studies as well as retinal interfacing

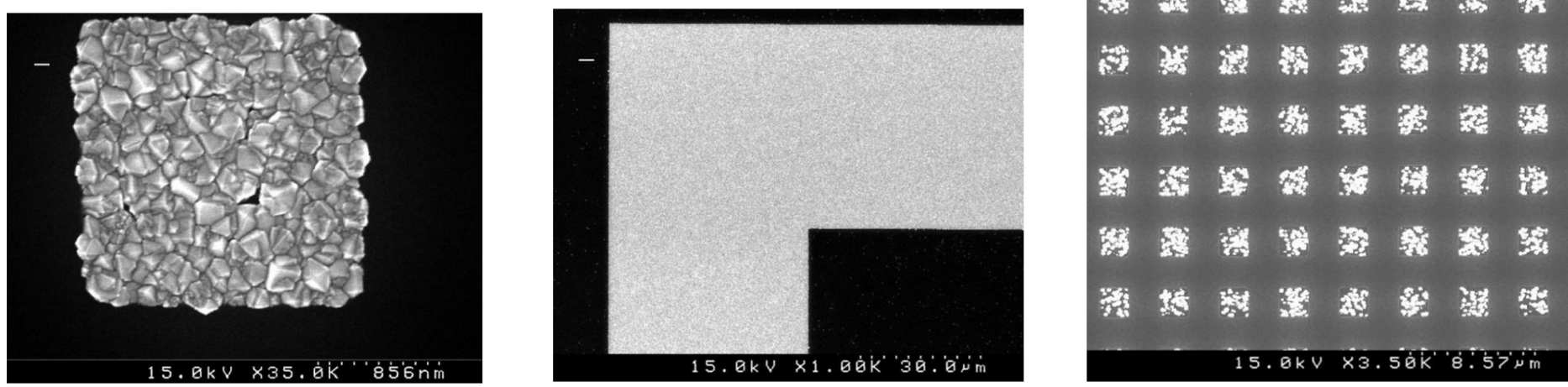
Processing routes

Two approaches :

- Selective patterning using BEN on metal strips / lines

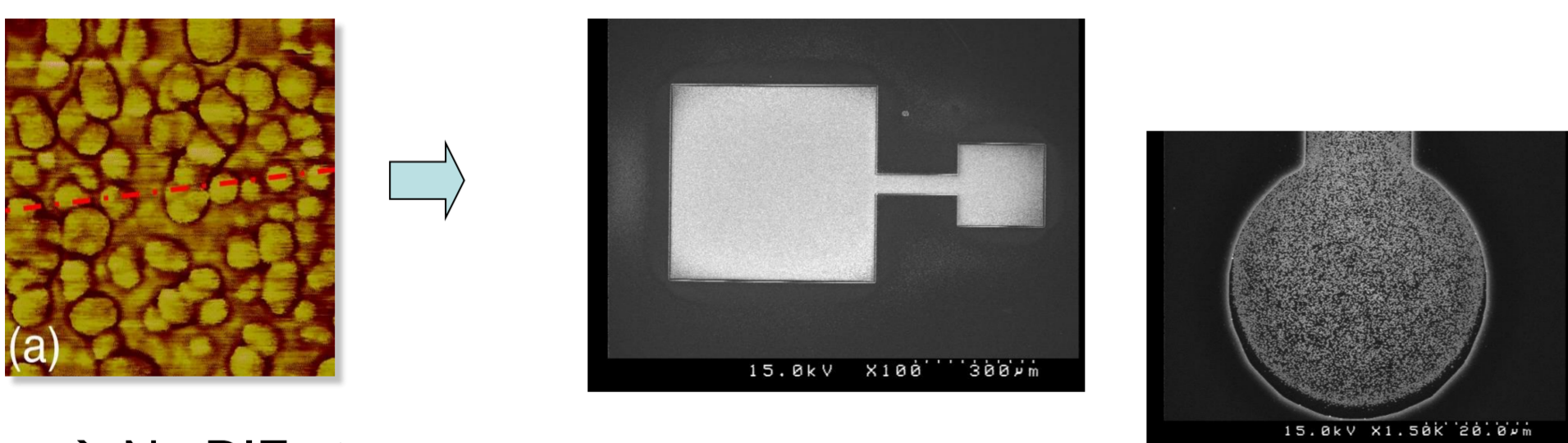


Patterning using SiO₂ masks



- Selective nanoseeding patterning

In collaboration with universiteit hasselt

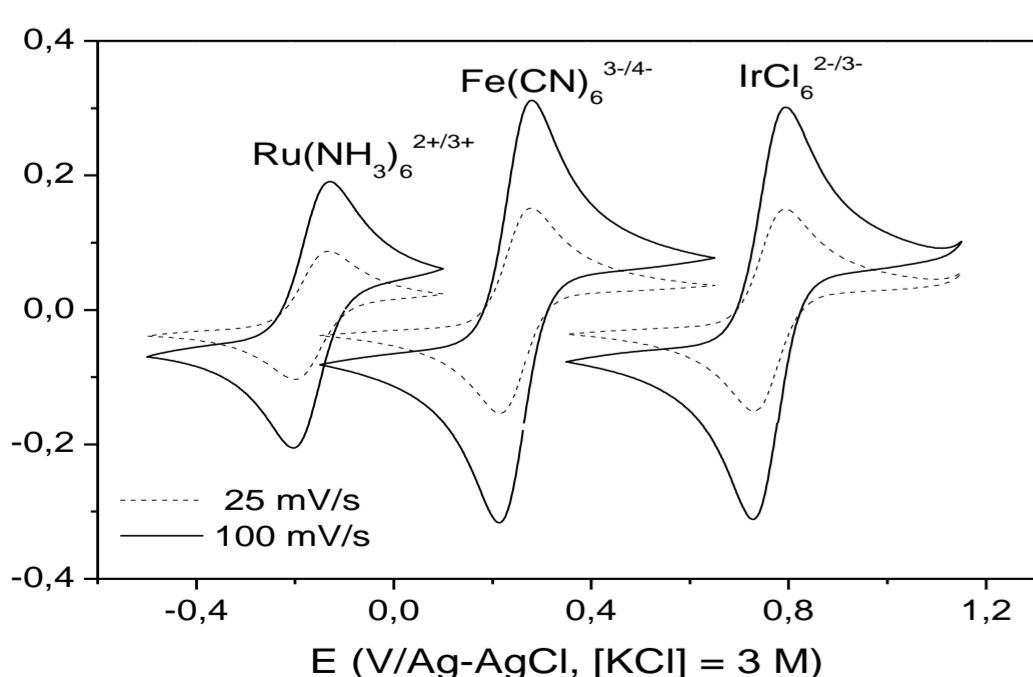
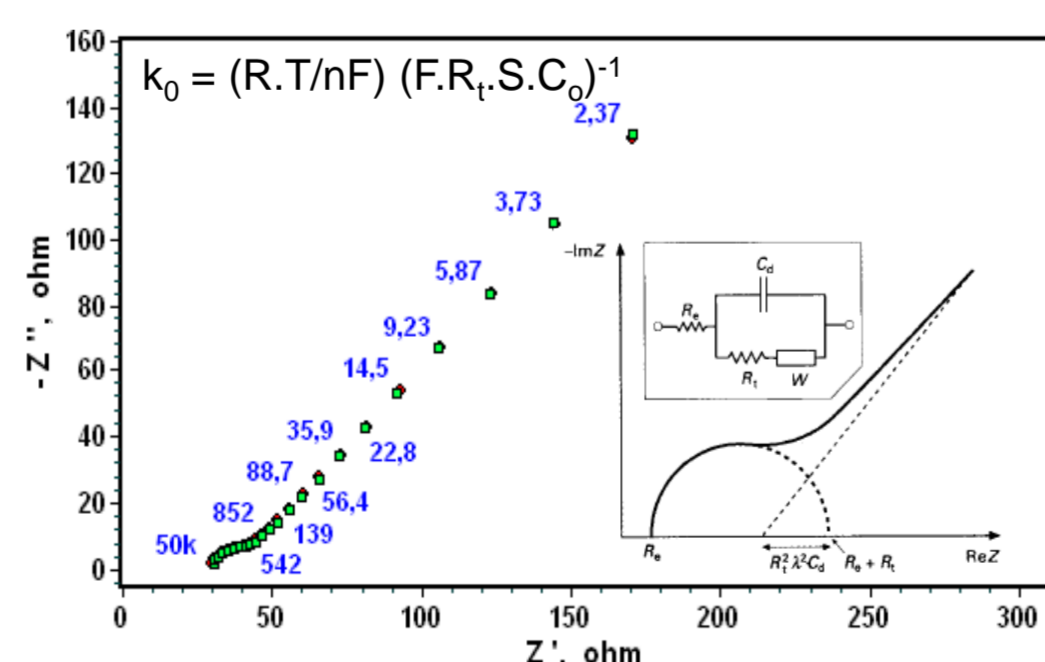


→ No RIE step

Electrochemical characterisation

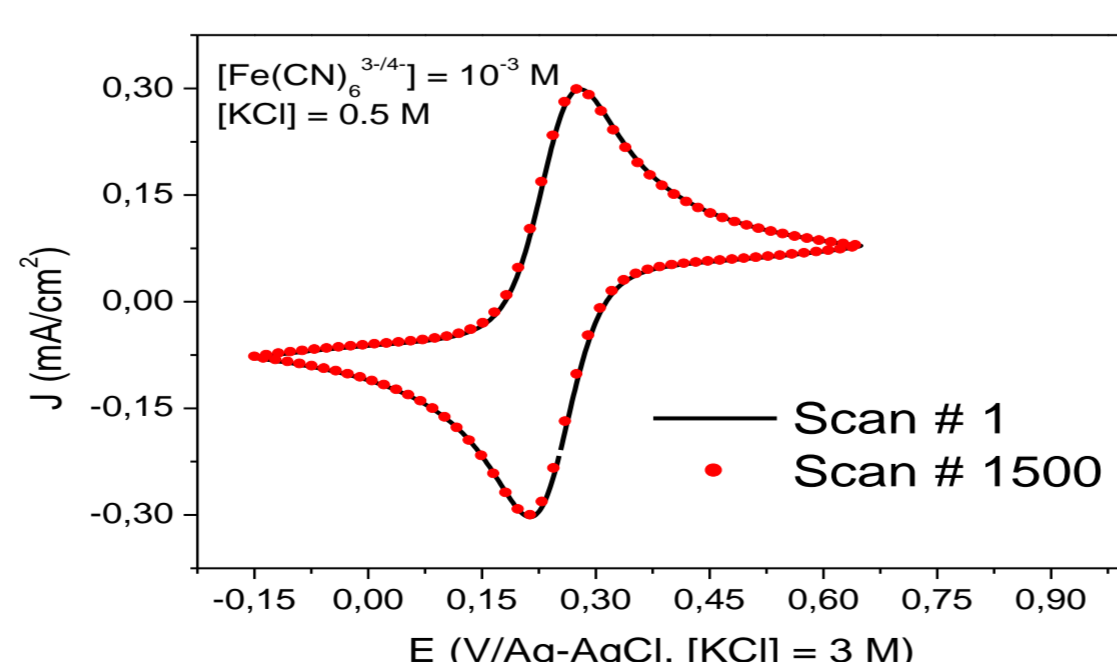
- Optimised Activation treatment
- Reactivity ~ Pt
- Electrochem window ~ x2 Pt

	k_0 (cm/s)
Before activation	0.00086
After activation	0.085



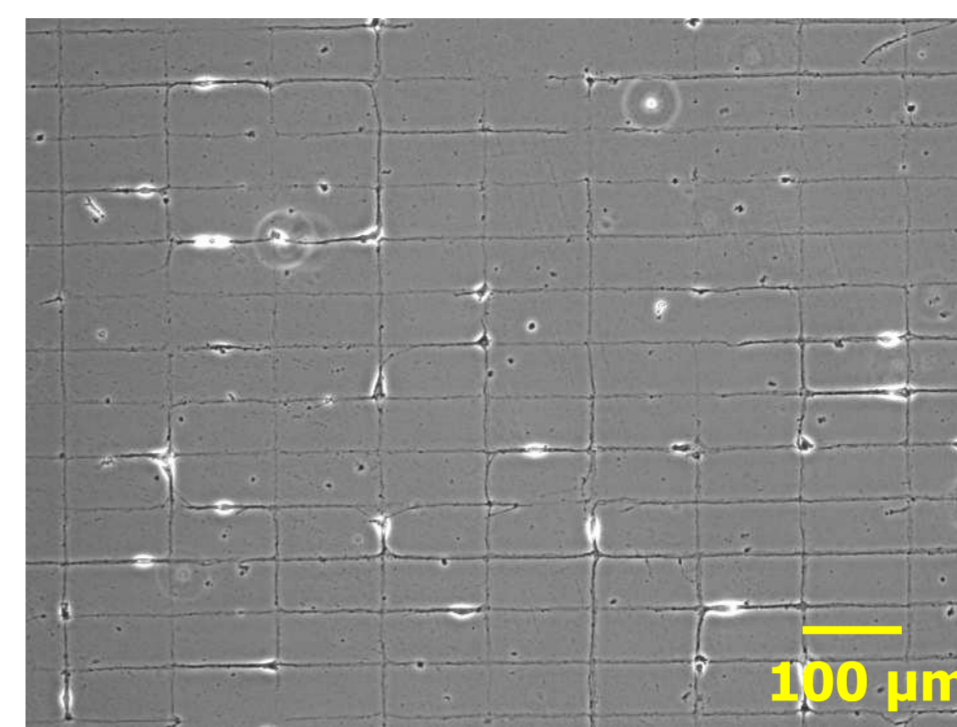
Extremely stable electrochem behaviour was assed during more than 1500 cycles of voltammetry between -0.3 V & 0.3V

Stability after 1500 cycles

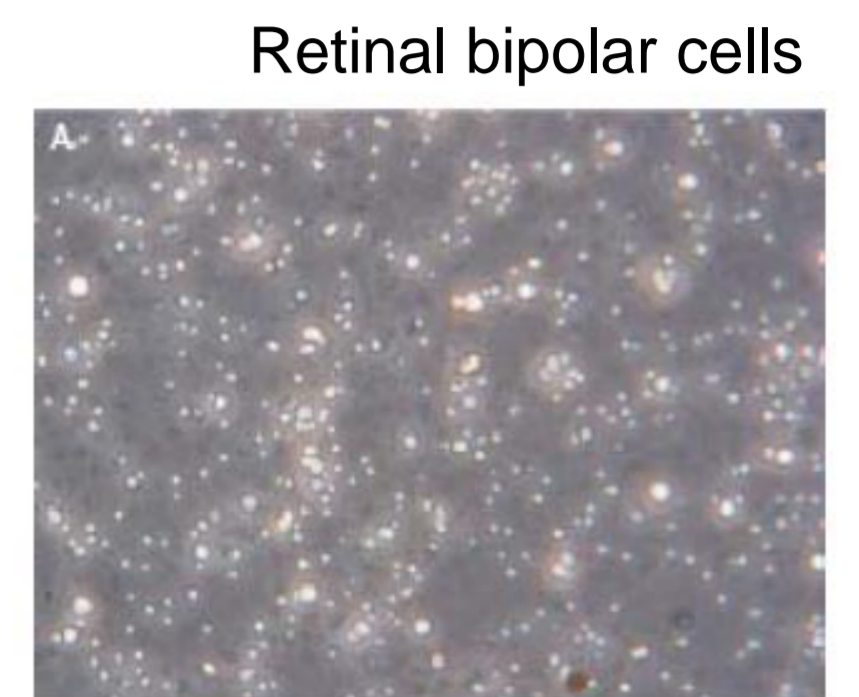


Biocompatibility Studies

Cells on diamond :



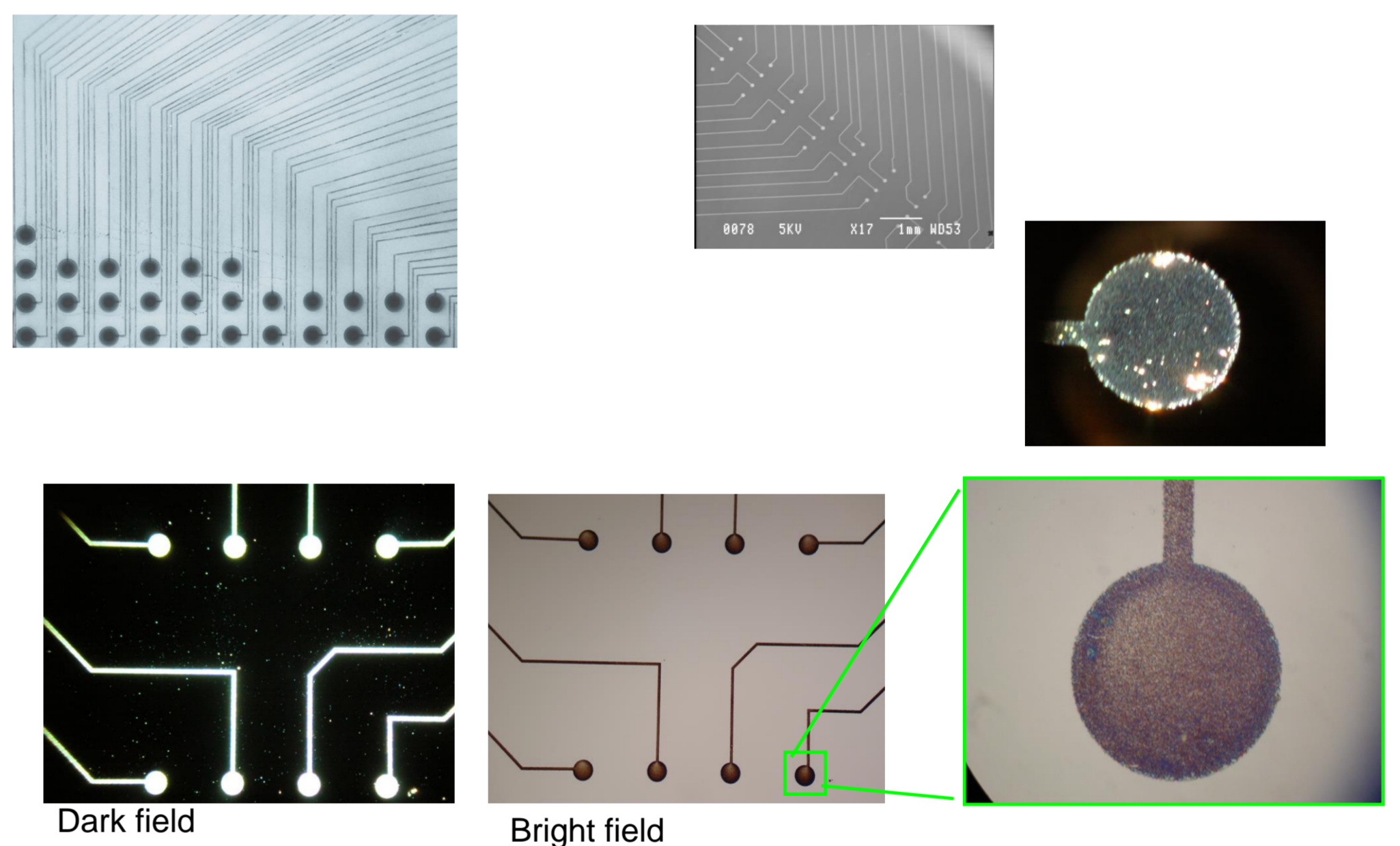
Patterned cortical neurons,
On polylysine pattern (DIV 10)



Retinal bipolar cells

Insert
→ As good as glass (control)

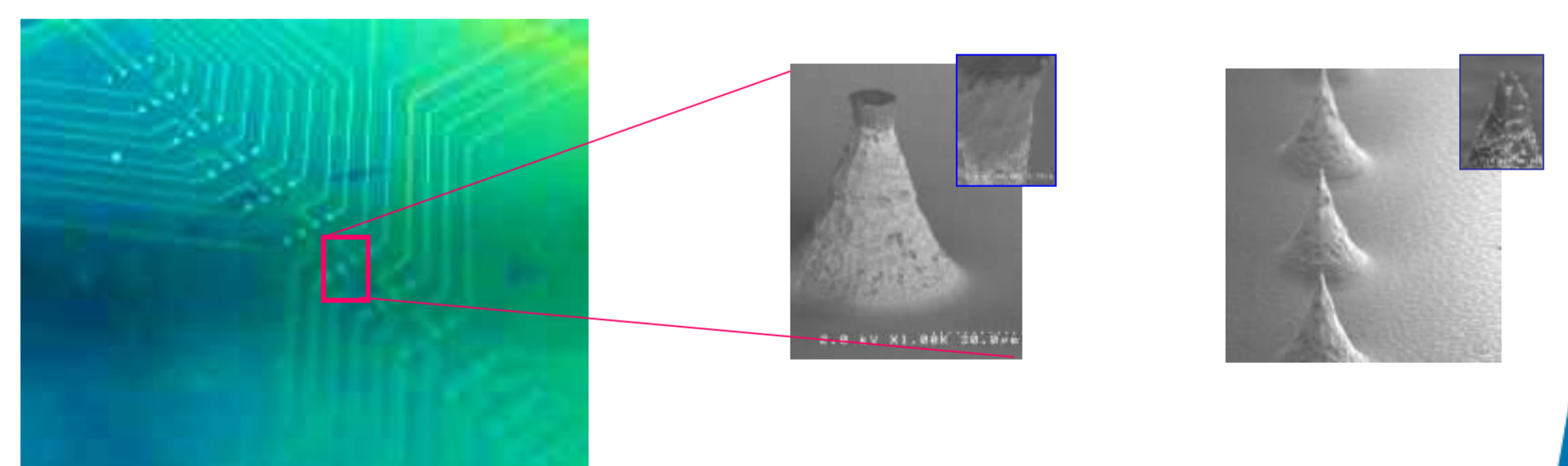
2D MEAs



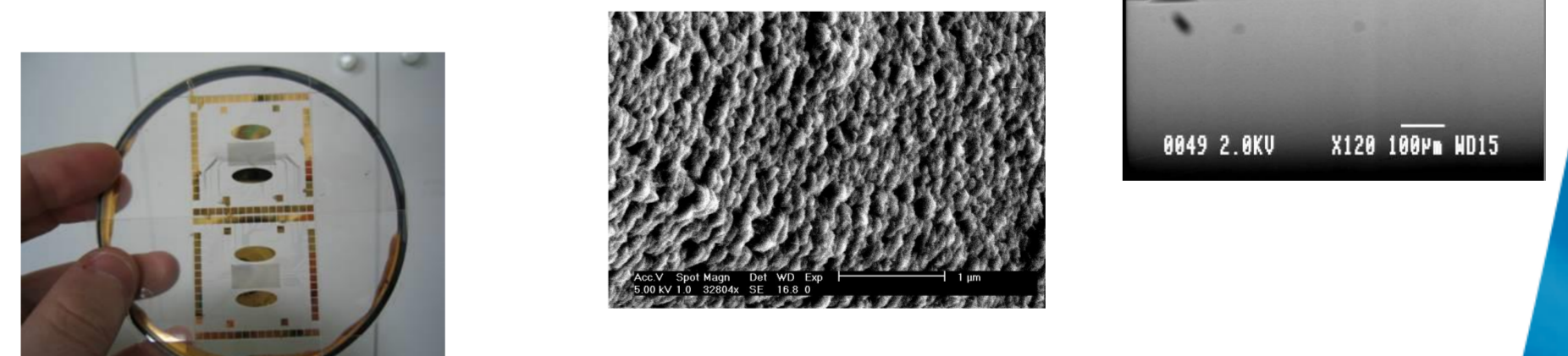
* M. Bonnauron, Diamond'07 (2007)

3D MEAs

- From BEN on Si



- From nanoseeding on glass



Acknowledgements

