

# Self-assembled fibrillar glycolipid hydrogels containing aligned monodisperse silver nanoparticles

K. Ozkaya<sup>1</sup>, H. Remita<sup>2</sup>, I. Lampre<sup>2</sup>, N. Baccile<sup>1</sup>

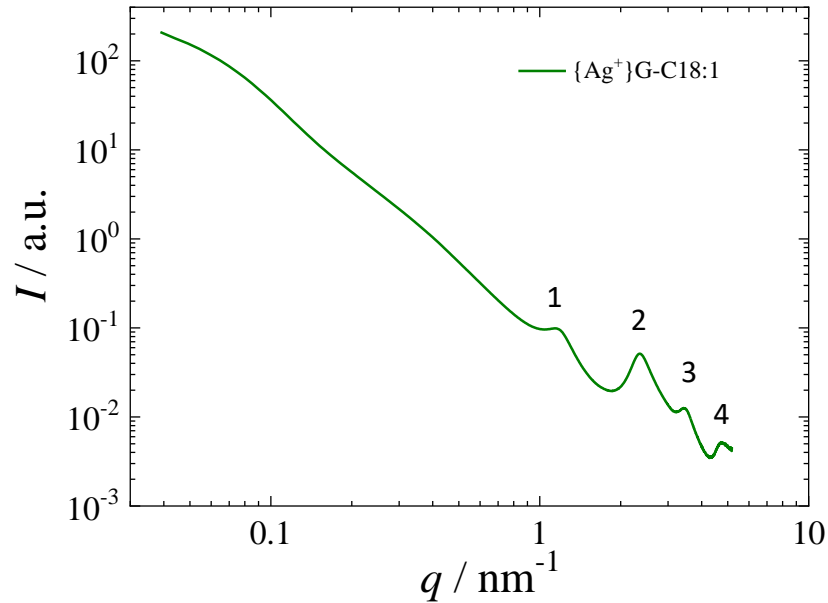
<sup>1</sup>*Sorbonne Université, Laboratoire de Chimie de la Matière Condensée de Paris (LCMCP), UMR CNRS 7574, Paris 75005, France*

<sup>2</sup>*Université Paris-Saclay, CNRS, Institut de Chimie Physique (ICP), UMR 8000, Faculté des Sciences d'Orsay, 91405 Orsay, France*

[niki.baccile@sorbonne-universite.fr](mailto:niki.baccile@sorbonne-universite.fr)

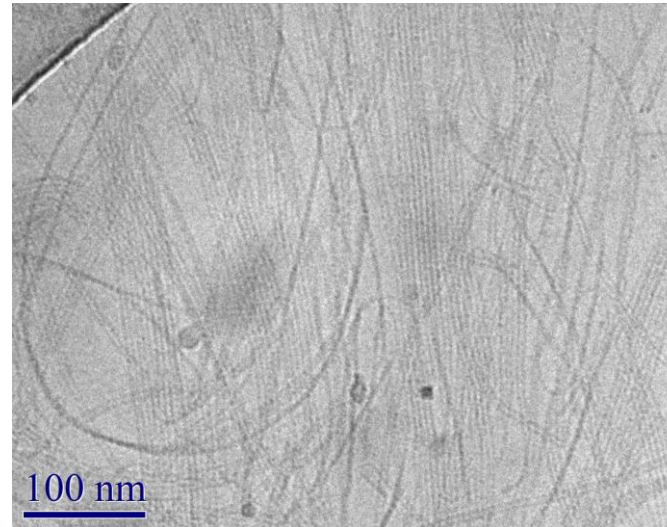
# Ag<sup>+</sup> -glycolipid hydrogels

SAXS



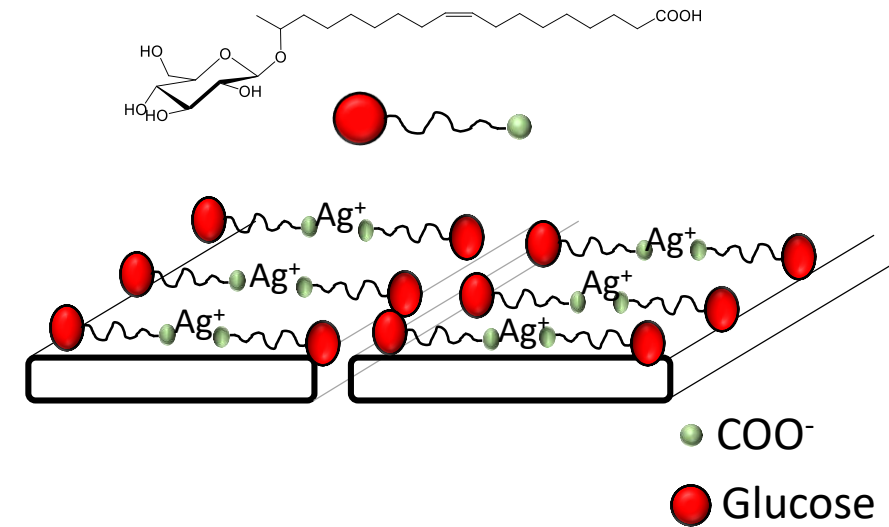
- Series of diffraction peaks : Crystalline flat structures in a lamellar order
- 1st peak at  $1.18 \text{ nm}^{-1}$  : 5.32 nm repeating distance

Cryo-TEM



- Fibers undergoing side-by-side association
- Each fiber has a cross section of 5 nm

Possible gel structure



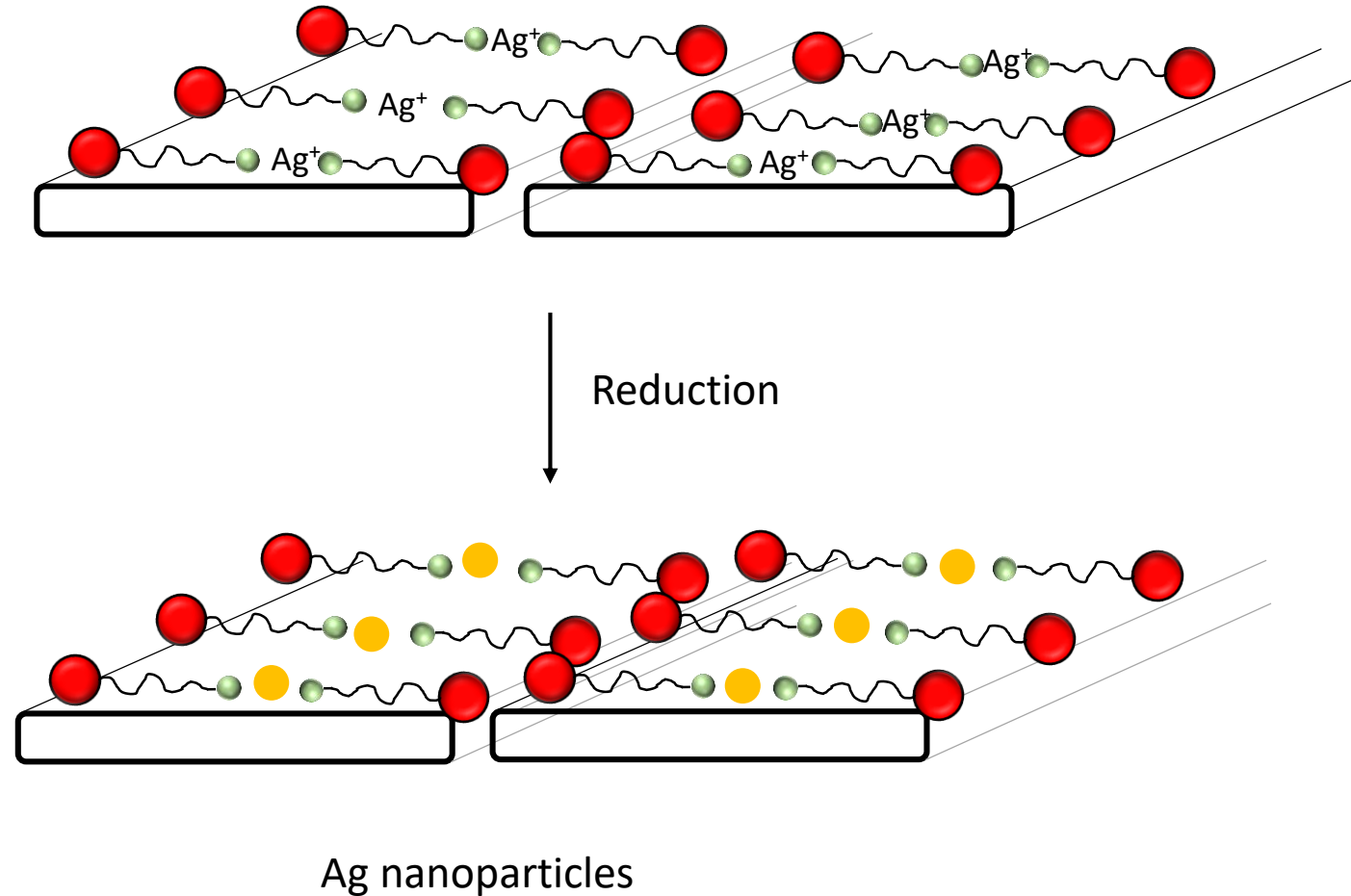
- COO<sup>-</sup> ..... Ag<sup>+</sup> coordination

# Reducing metal centers

Reducing the metal centers by

- Reducing agents:  $\text{NaBH}_4$  (*seconds*) or Ascorbic Acid (*minute*)
- Radiolysis with  $\gamma$  rays (*hours/days*)

to explore the possibility of introducing conductivity into the gels.



# Methods to reduce $\text{Ag}^+$

**$\text{AgClO}_4$**



Control

Method 1

$\text{NaBH}_4$



Method 2

Ascorbic Acid



Method 3

Radiolysis



2h



4h30



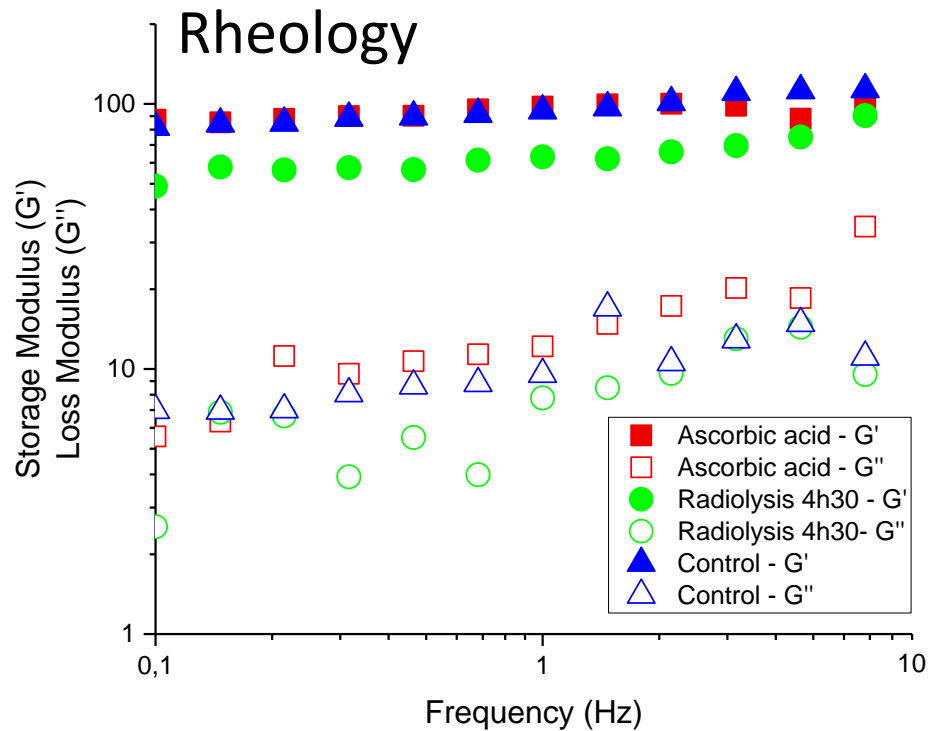
12h



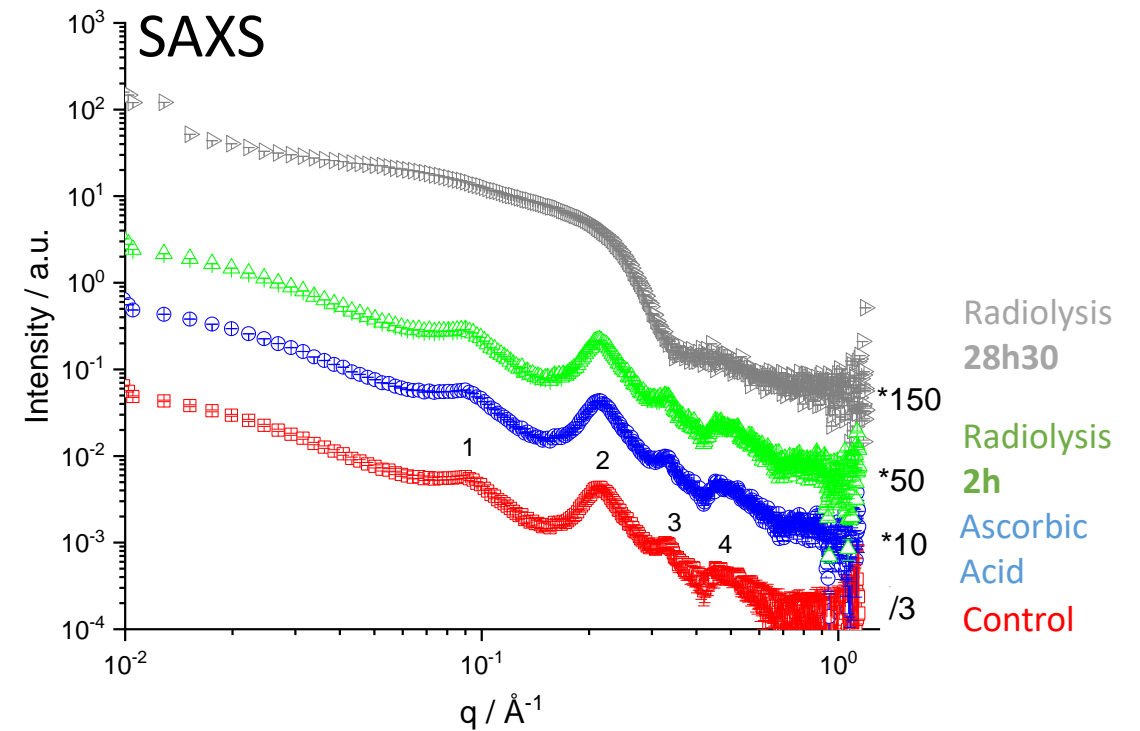
28h30

# Elastic Properties and structure after reduction

Gel elastic properties preserved

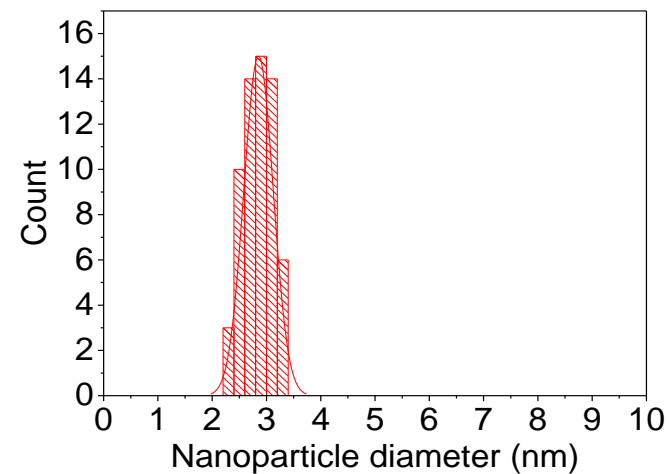
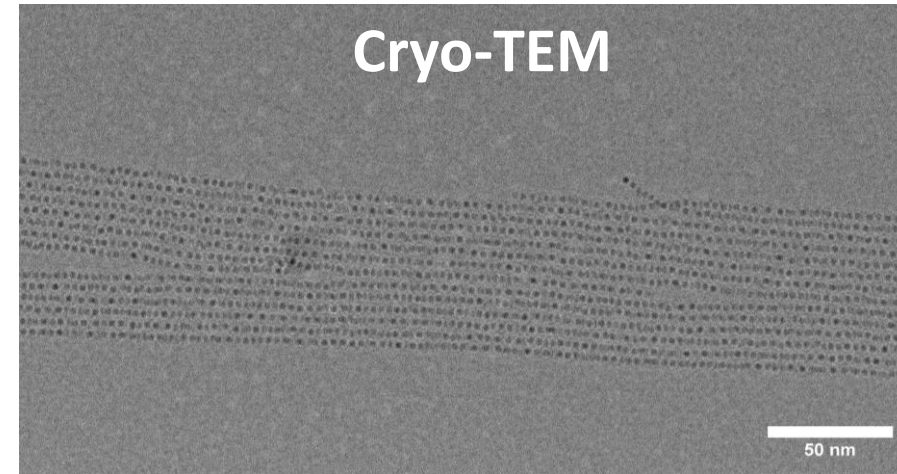
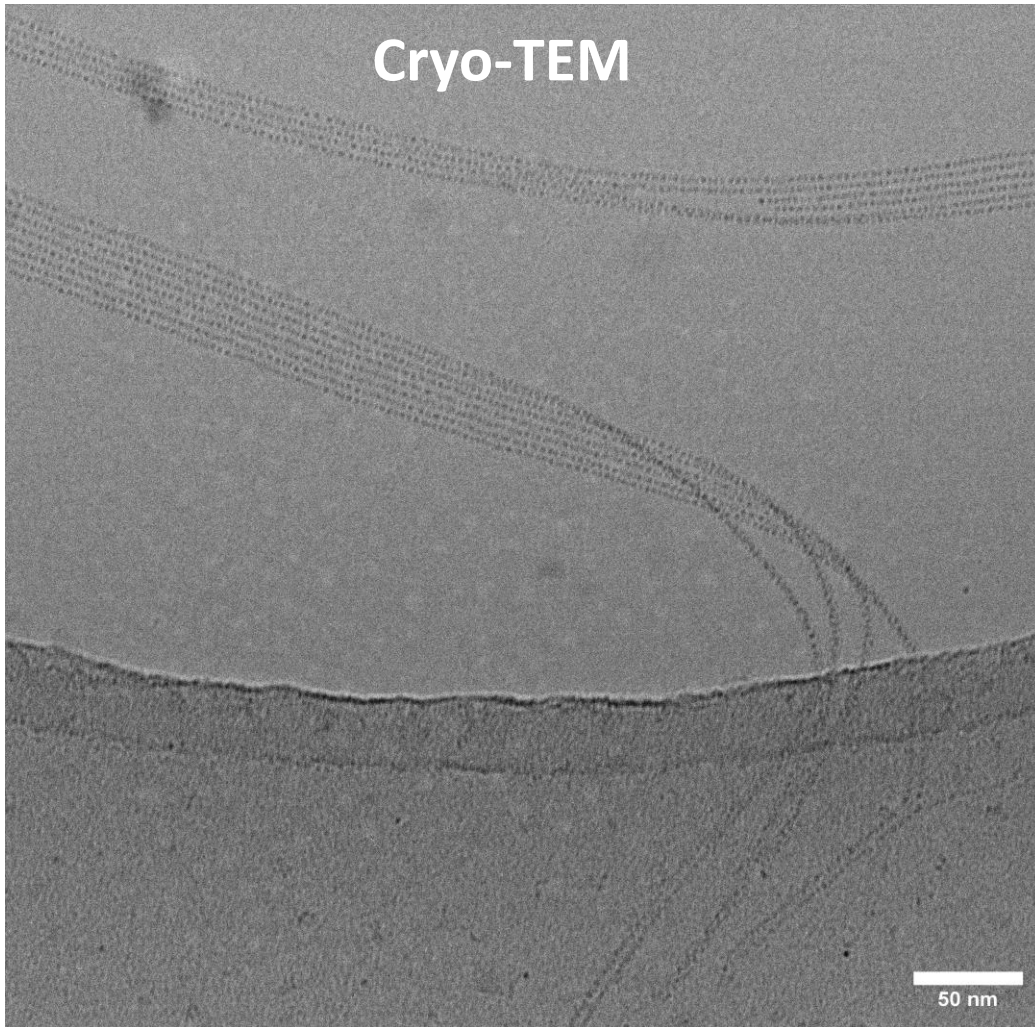


Gel structure preserved (within limits)



# Electron Microscopy

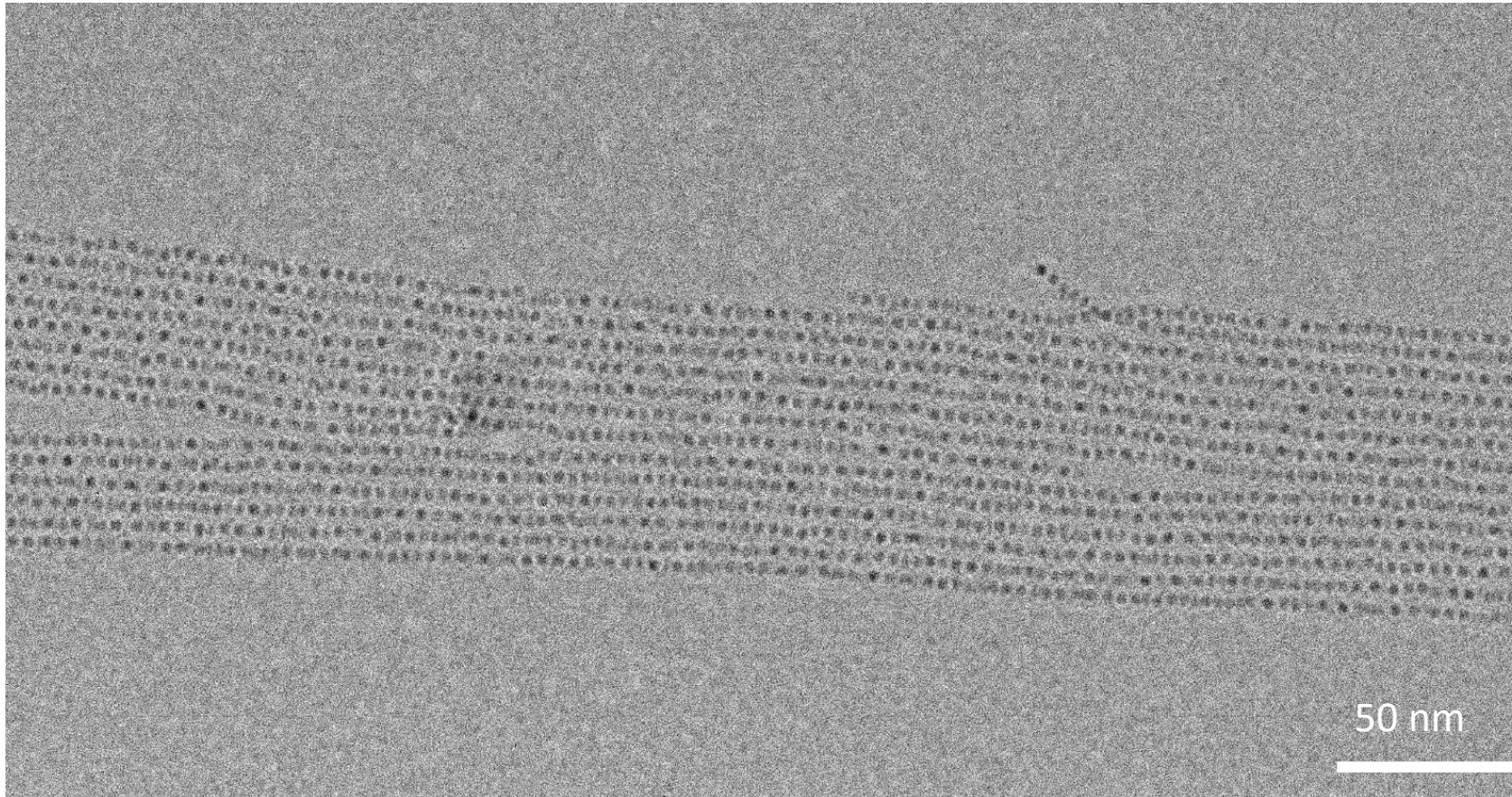
## Radiolysis 2h



- ✓ Ag nanoparticles aligned with the fibers, with an average size of 2,8 nm and dispersity (full width half maximum) of 0.6 nm, 20% dispersion.

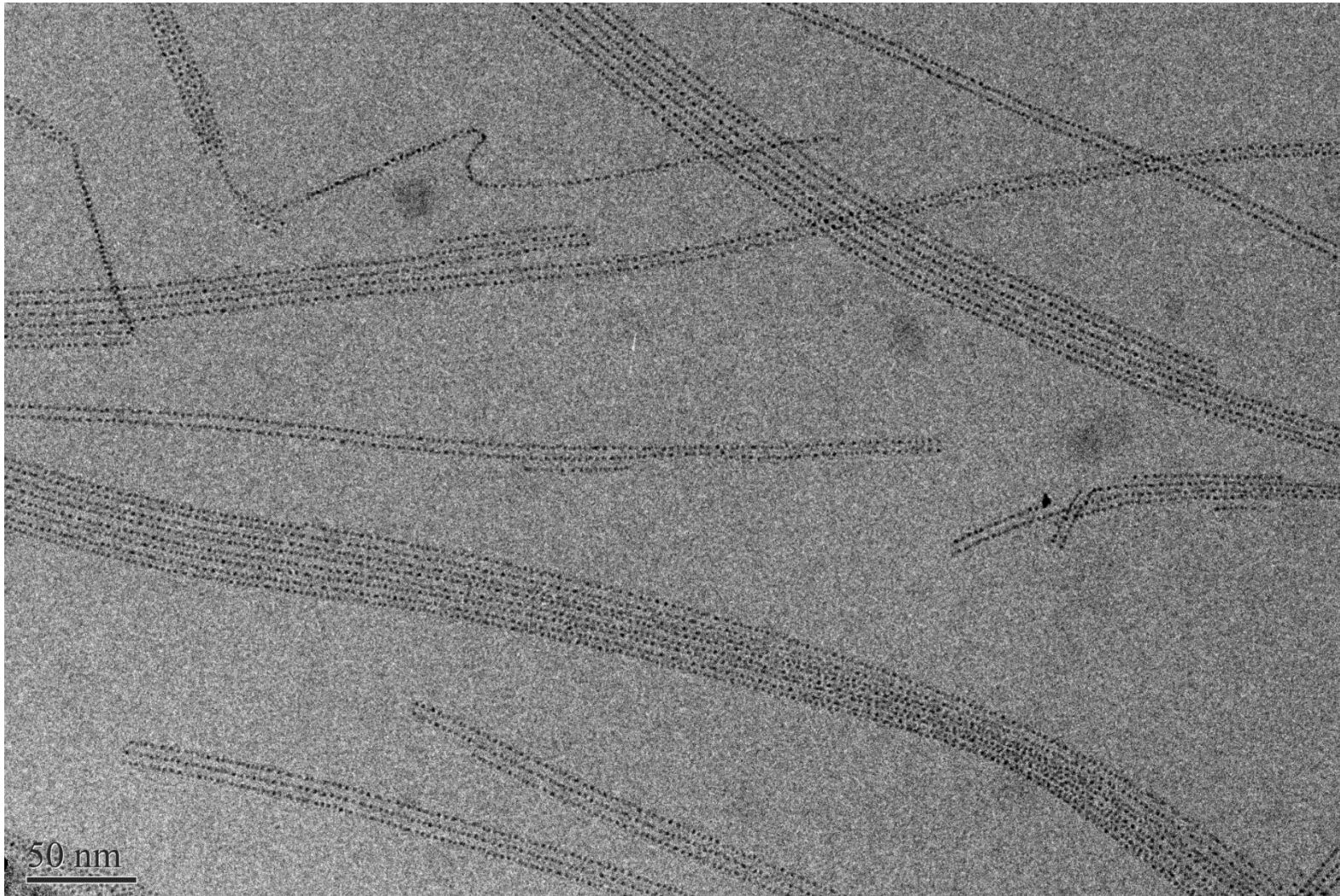
# Electron Microscopy

## Radiolysis 2h



# Electron Microscopy

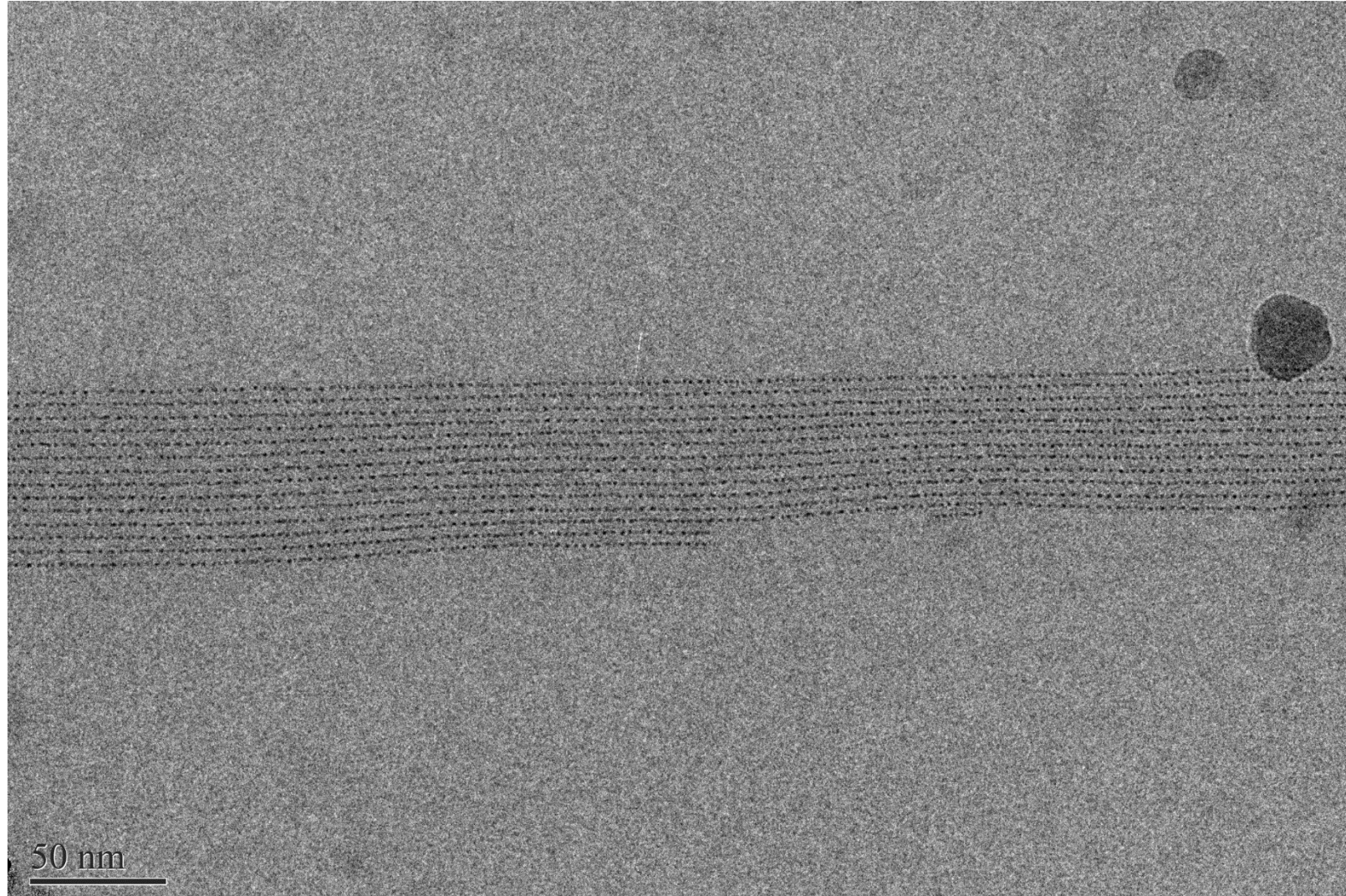
## Radiolysis 2h





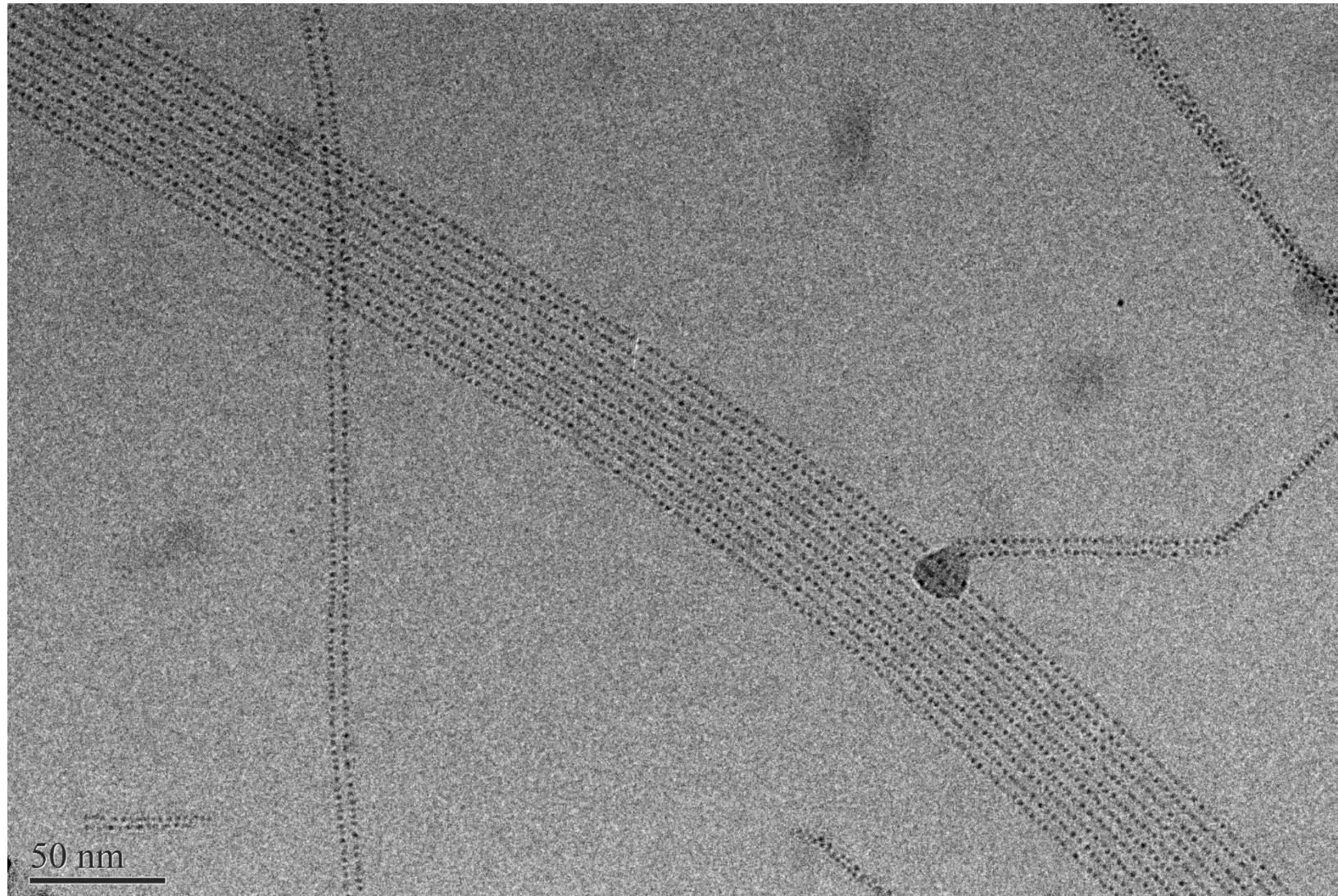
# Electron Microscopy

## Radiolysis 2h

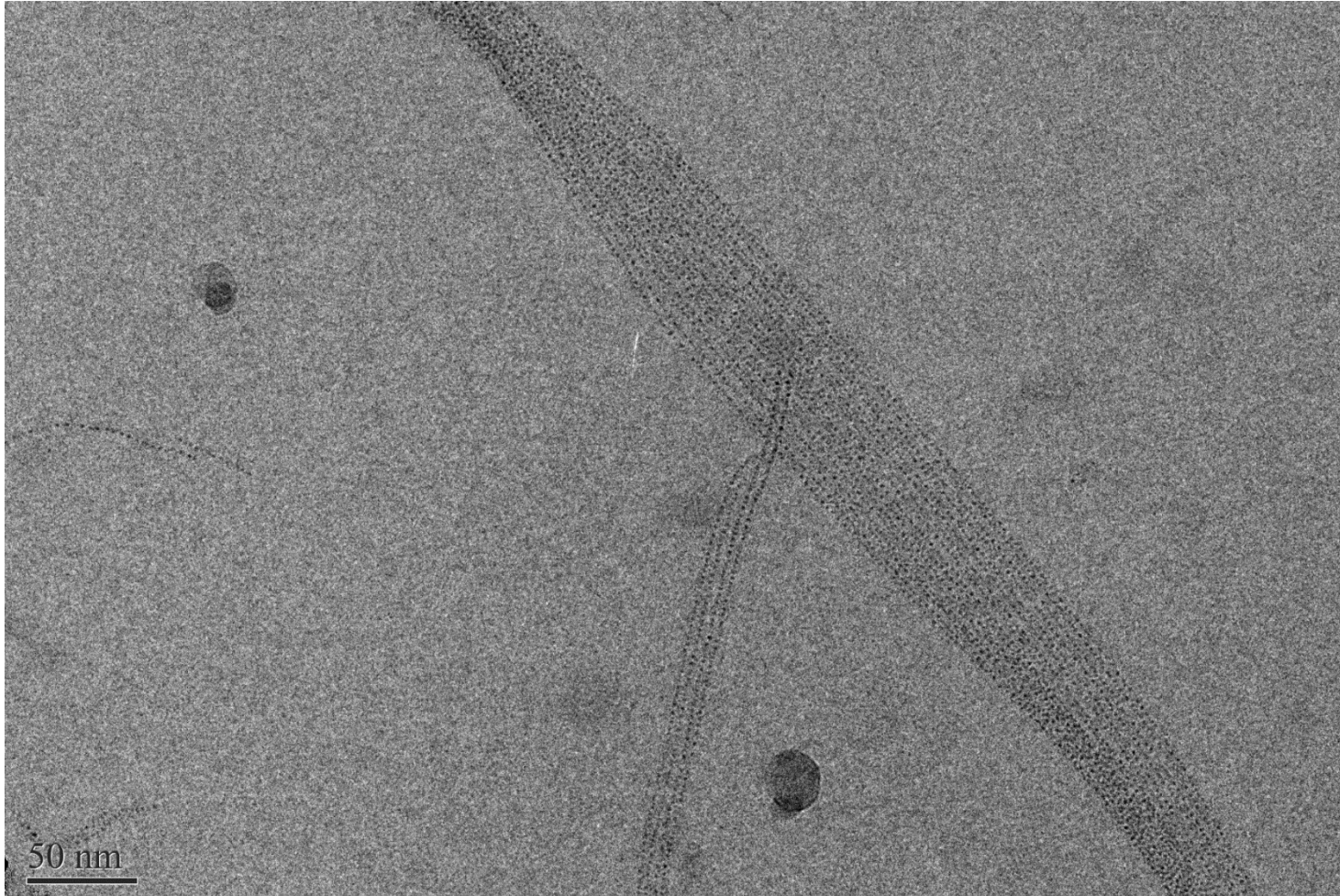


# Electron Microscopy

## Radiolysis 2h



# Questions ouvertes



Est-ce que un tel ordre de NP de Ag a un intérêt a été étudié?

Est-ce qu'il y a des propriétés particulières, qui valent le coup d'être explorées?

Est-ce que l'Ag est un système intéressant? Faut-il tenter de développer un assemblage similaire mais constitué d'autres métaux?