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Supporting Information

Flexible Transparent Conductive Films Based on Slot Die Coating Induced Oriented Silver Nanowire Networks

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1 S1. Image Processing and Orientation Analysis

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3 The orientation of AgNWs was analyzed using a custom Python-based image processing workflow,
4 including image preprocessing, ridge enhancement, binarization, skeletonization, and orientation
5 extraction via principal component analysis (PCA). A simplified version of the code is provided
6 below:

```
# Read grayscale image
img = cv2.imread(image_path, cv2.IMREAD_GRAYSCALE)

# Background correction
img_bg = white_tophat(img, disk(15))

# Ridge enhancement (simplified)
resp = enhance_ridges_multi(img_bg)

# Thresholding (binarization)
thr = np.percentile(resp, 90)
bw = resp > thr

# Morphological refinement
bw = binary_closing(bw, disk(2))
bw = remove_small_objects(bw, 30)

# Skeletonization
sk = skeletonize(bw)

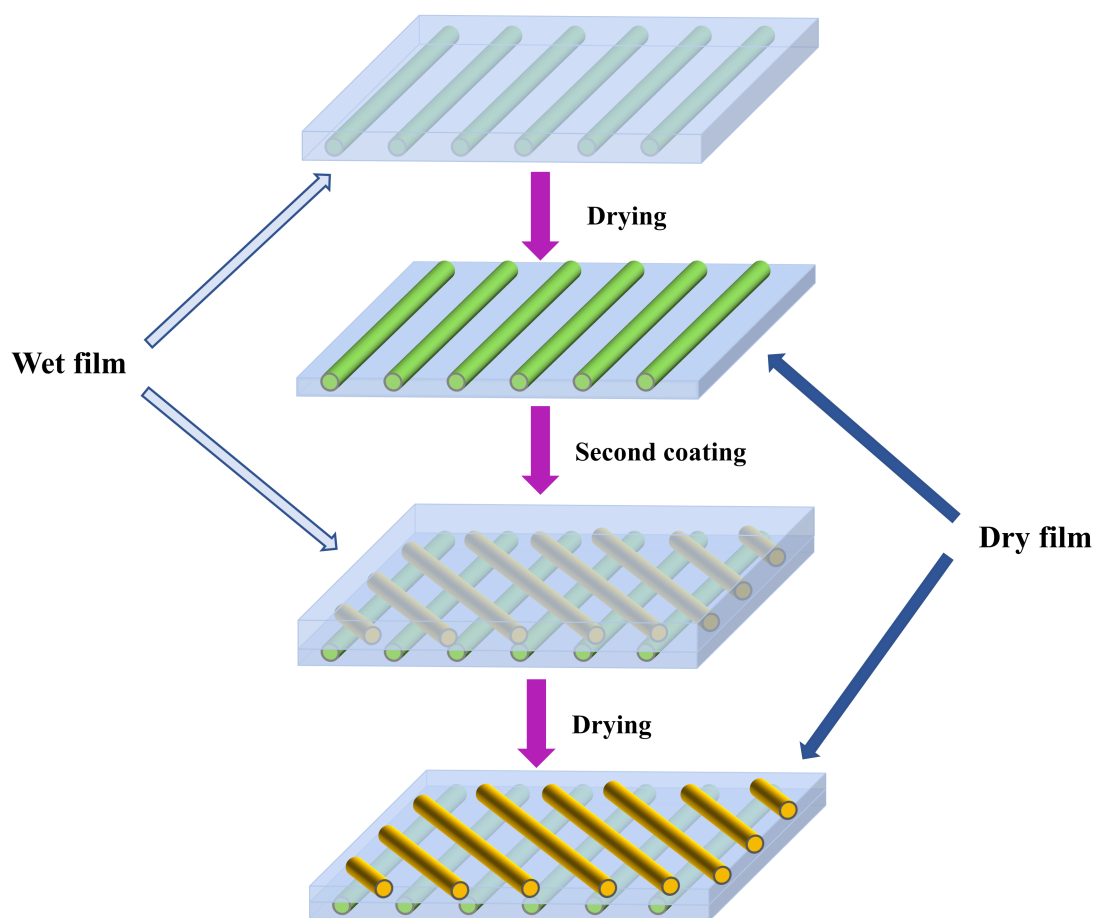
# PCA-based orientation calculation
coords = np.column_stack(np.nonzero(sk))
cov = np.cov(coords.T)
eigvals, eigvecs = np.linalg.eig(cov)

# Orientation angle (radian)
angle = np.arctan2(eigvecs[1, 0], eigvecs[0, 0])
angle_deg = np.degrees(angle)
```

7 Wherein *img* represents the original SEM image, *resp* is the enhanced ridge response, *bw* denotes
8 the binarized image, and *coords* corresponds to the pixel coordinates of the extracted nanowire
9 skeleton.

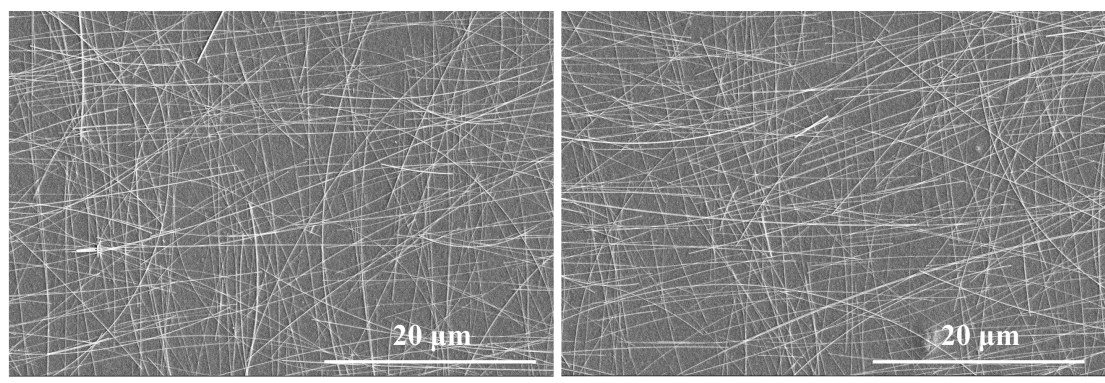
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1 **Fig. S1.** Schematic illustration of the formation mechanism of the insulating HPMC layer in bilayer
2 orthogonal AgNWs TCFs.
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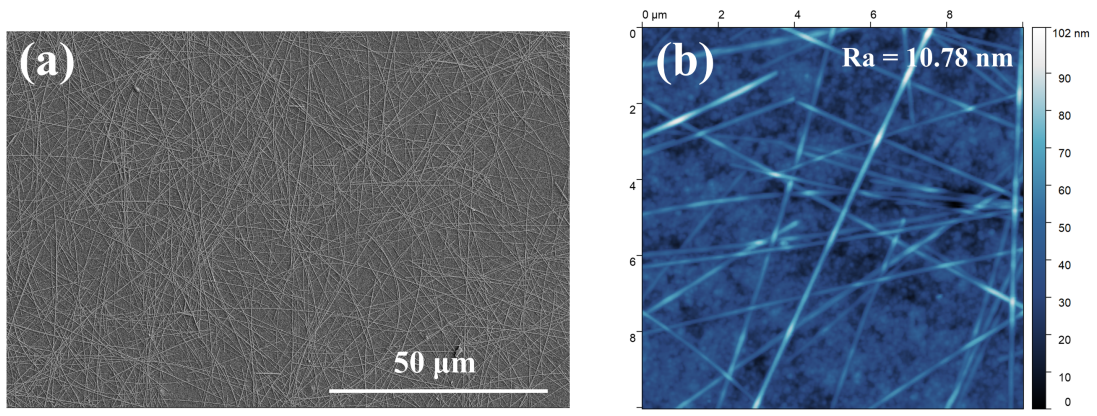
1 **Fig. S2.** Additional SEM images



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1 **Fig. S3.** SEM and AFM images of randomly distributed AgNWs films with comparable sheet
2 resistance prepared by single slot-die coating.



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