Supplementary Information

Léo Sifringer, Daniel Laguna, Michel Sommer, and János Vörös

January 6, 2025

Laboratory of Biosensors and Bioelectronics, ETH Zürich, Gloriastrasse 37/39, Zürich, Switzerland

Study	**Constant parameters**
Angle	Length 50μm, Width 3μm, Sp. lengthwise 50μm, Sp. widthwise 25μm
Length	Angle 0°, Width 2μm, Sp. lengthwise 5μm, Sp. widthwise 2μm
Width	Angle 0°, Length 50μm, Sp. lengthwise 5μm, Sp. widthwise 4μm
Spacing length-wise	Angle 0°, Length 50μm, Width 3μm, Sp. widthwise 4μm
Spacing width- wise	Angle 0°, Length 50μm, Width 3μm, Sp. lengthwise 25μm

Table S1: Summary table of the parameters used for the mechanical characterization tests. All thicknesses are 100nm

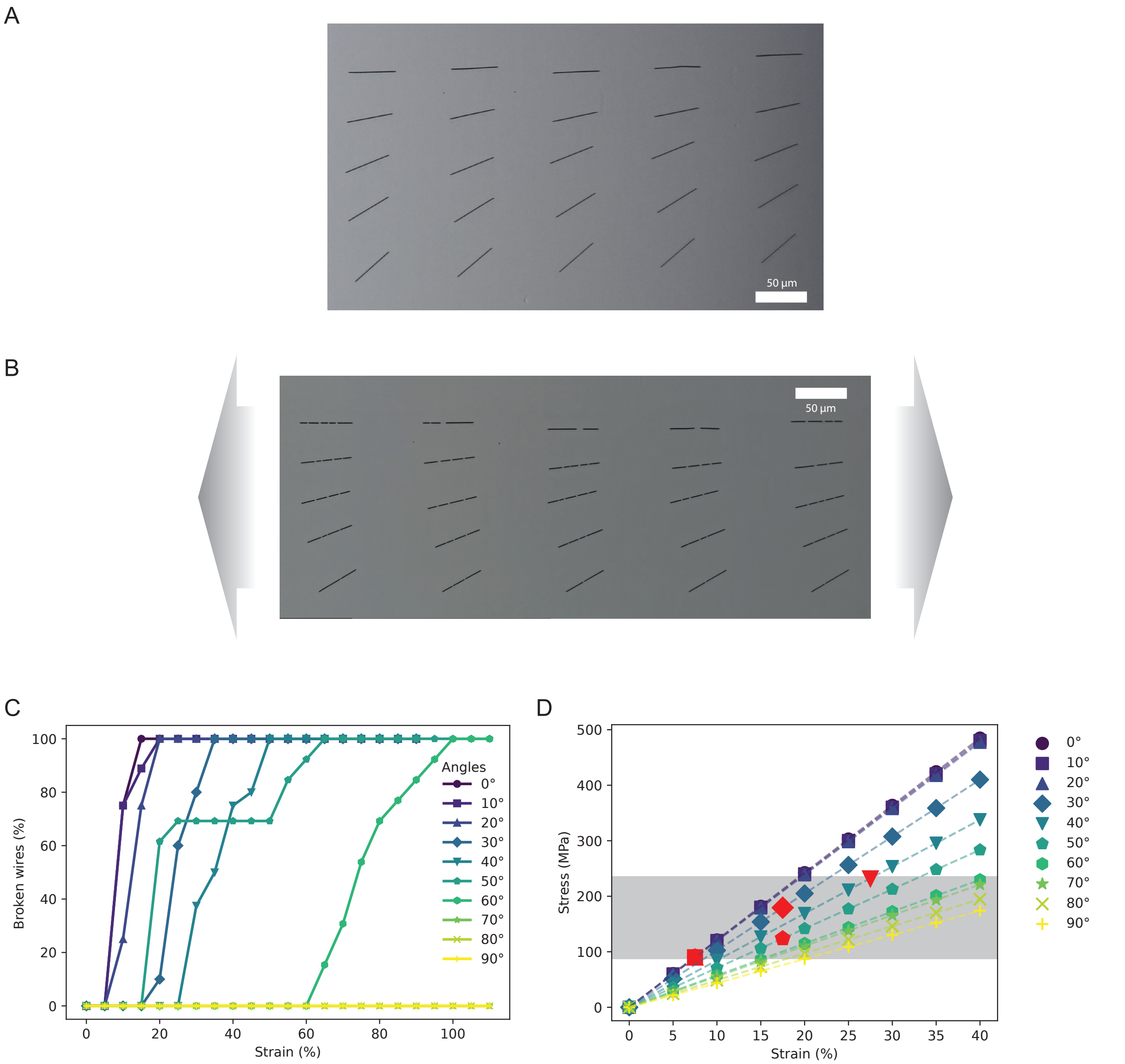

Figure S1: (A) Representative image of a sample used for mechanical testing, at rest. (B)Representative image of a sample used for mechanical testing, under strain (40 %).(C) Plot showing the transition of microwires from pristine to broken for each angle group.(D) FEA simulated maximum von Mises stress in each angle group. The red data points correspond to the measured strain at which the first wire break happens in a given group. The grey area represents the corresponding ultimate tensile stress.

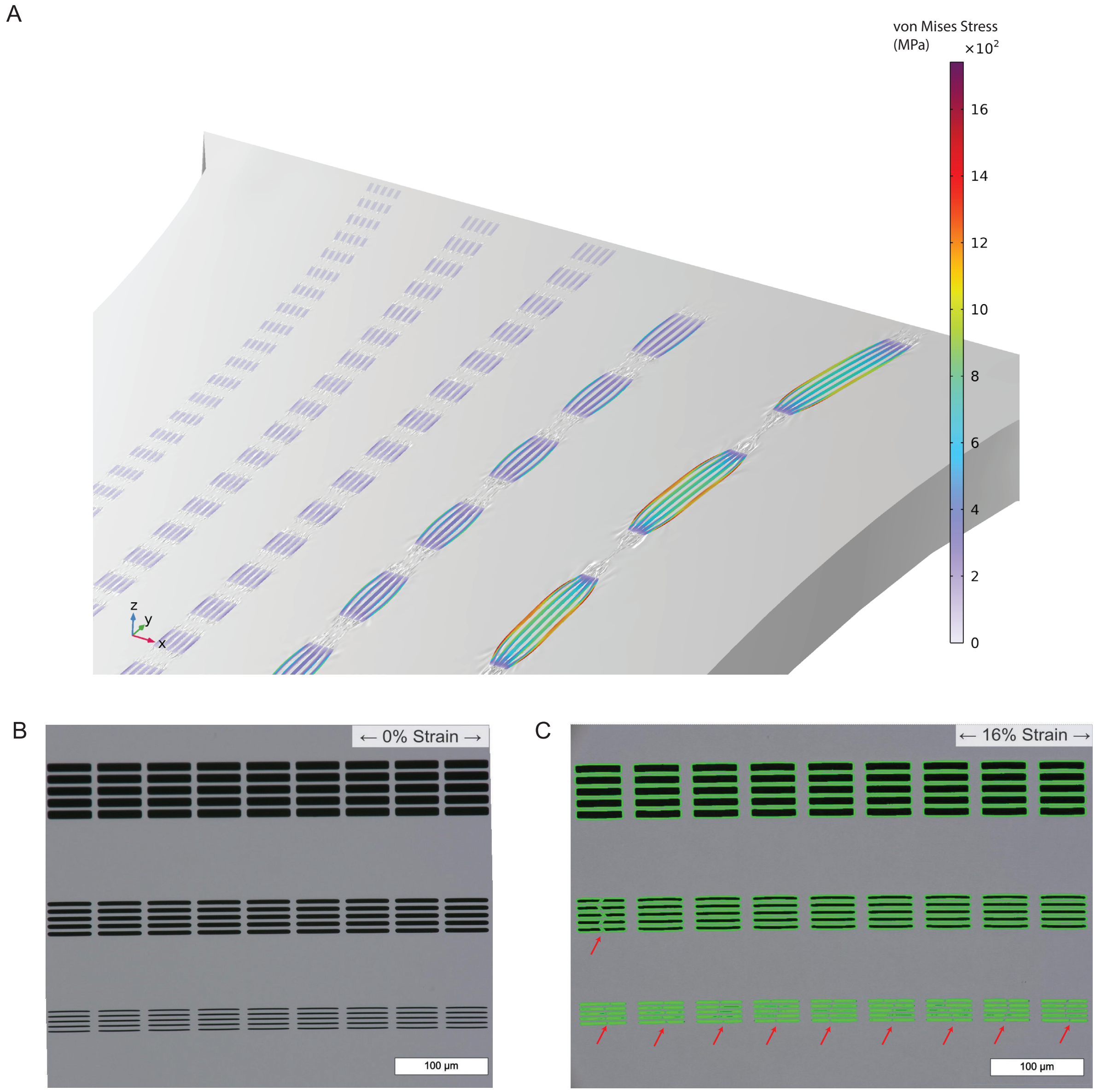

Figure S2: (A) FEA results of a strain test when testing the influence of wire length. The wires are colored according to the von Mises stress they experience, showing that longer wires experience more stress (B) Optical microscope picture of a sample used for testing the influence of wire width. (C) Same wires as in B), but under strain, and overlaid with the rectangle detection. The red arrows highlight locations where wires are visibly cracked.

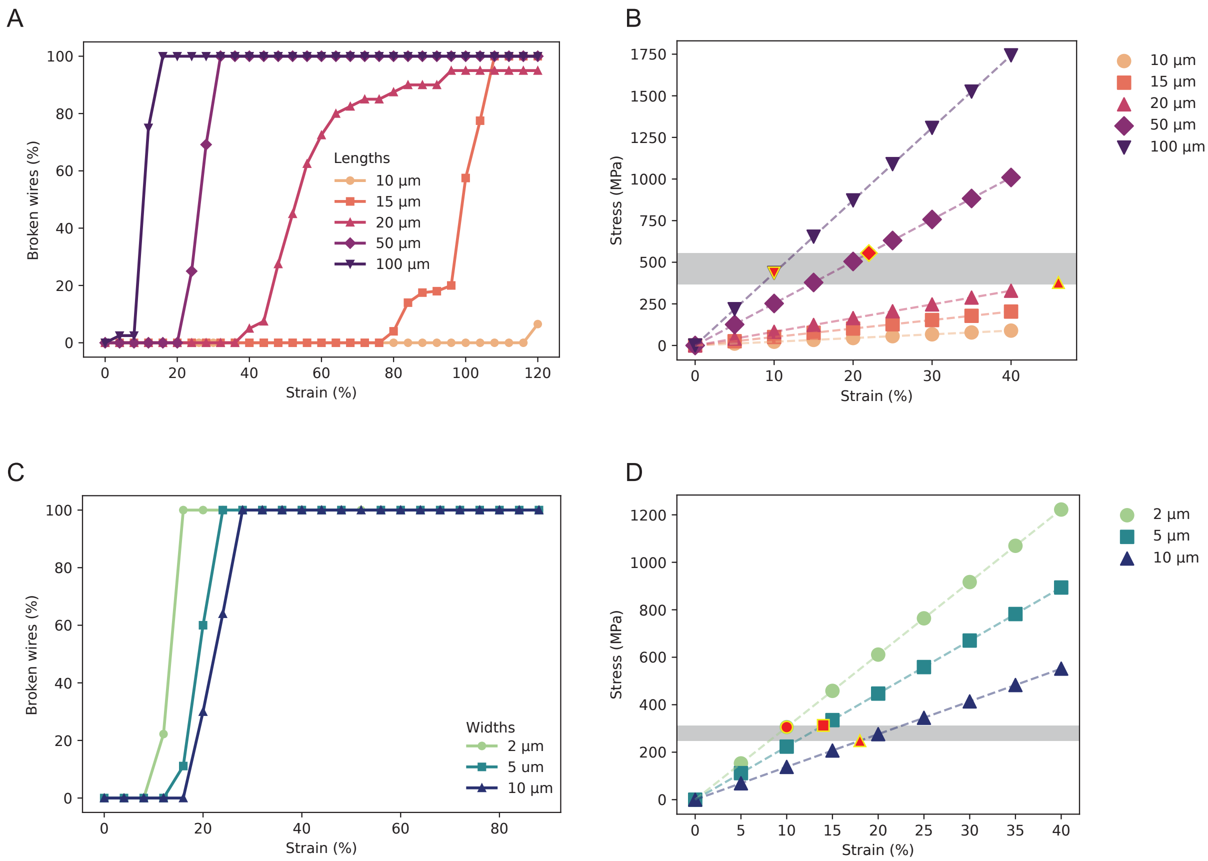

Figure S3: (A) Plot showing the transition of microwires from pristine to broken for each length group. (B) FEA simulated maximum von Mises stress in each length group. The red data points correspond to the measured strain at which the first wire break happens in a given group. The grey area represents the corresponding ultimate tensile stress.(C) Plot showing the transition of microwires from pristine to broken for each width group.(D) FEA simulated maximum von Mises stress in each width group. The red data points correspond to the measured strain at which the first wire break happens in a given group. The grey area represents the corresponding ultimate tensile stress.

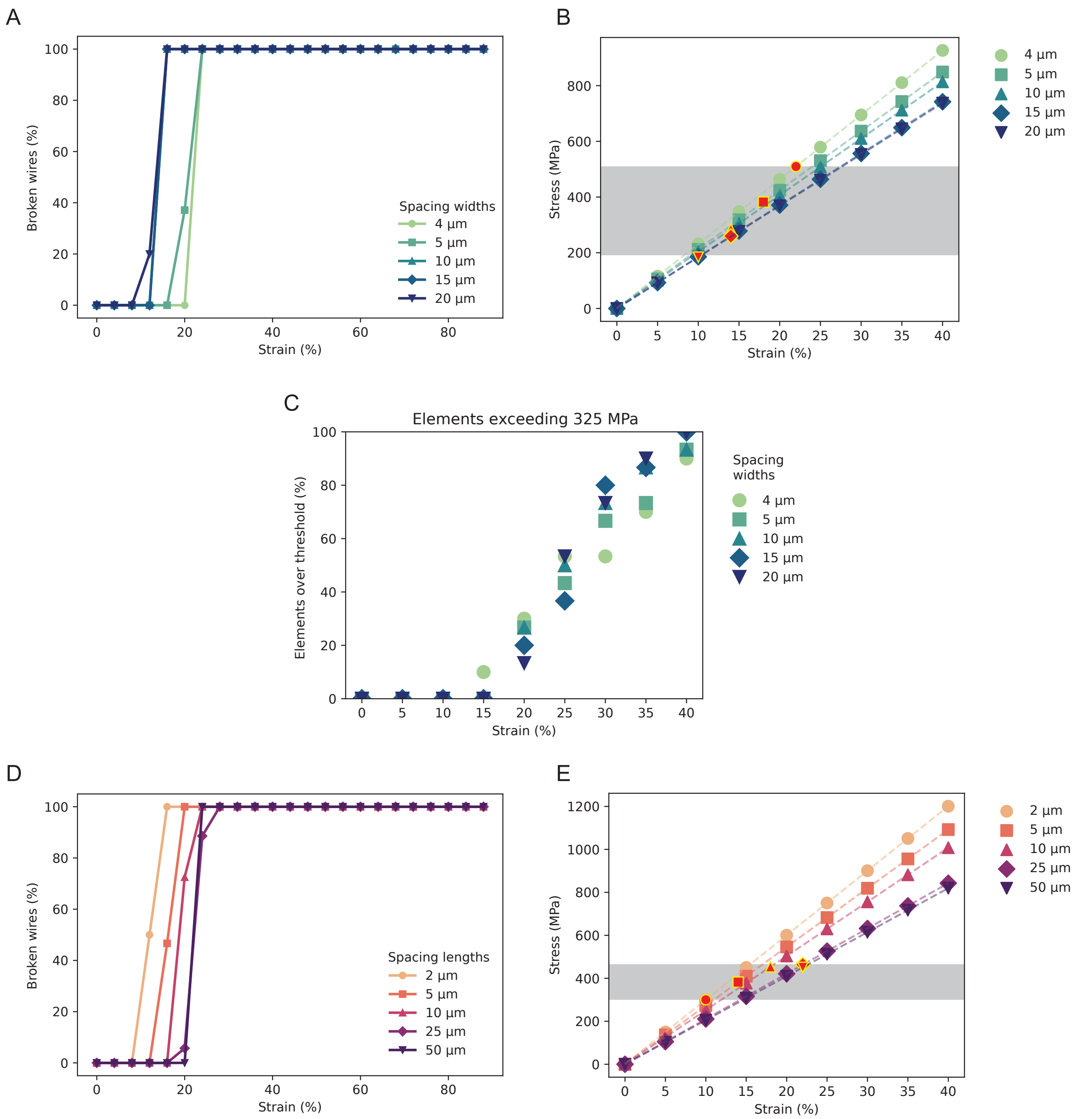

Figure S4: (A) Plot showing the transition of microwires from pristine to broken for each spacing-width group. (B) FEA simulated maximum von Mises stress in each spacing-width group. The red data points correspond to the measured strain at which the first wire break happens in a given group. The grey area represents the corresponding ultimate tensile stress. (C) Plot showing the percentage of wire in each spacing-width group experiencing a stress value above 325 MPa (FEA data) as function of strain. The value of 325 was chosen by averaging the ultimate tensile stress values obtained in B). (D) Plot showing the transition of microwires from pristine to broken for each spacing-length group. (E) FEA simulated maximum von Mises stress in each spacing-length group. The red data points correspond to the measured strain at which the first wire break happens in a given group. The grey area represents the corresponding ultimate tensile stress.

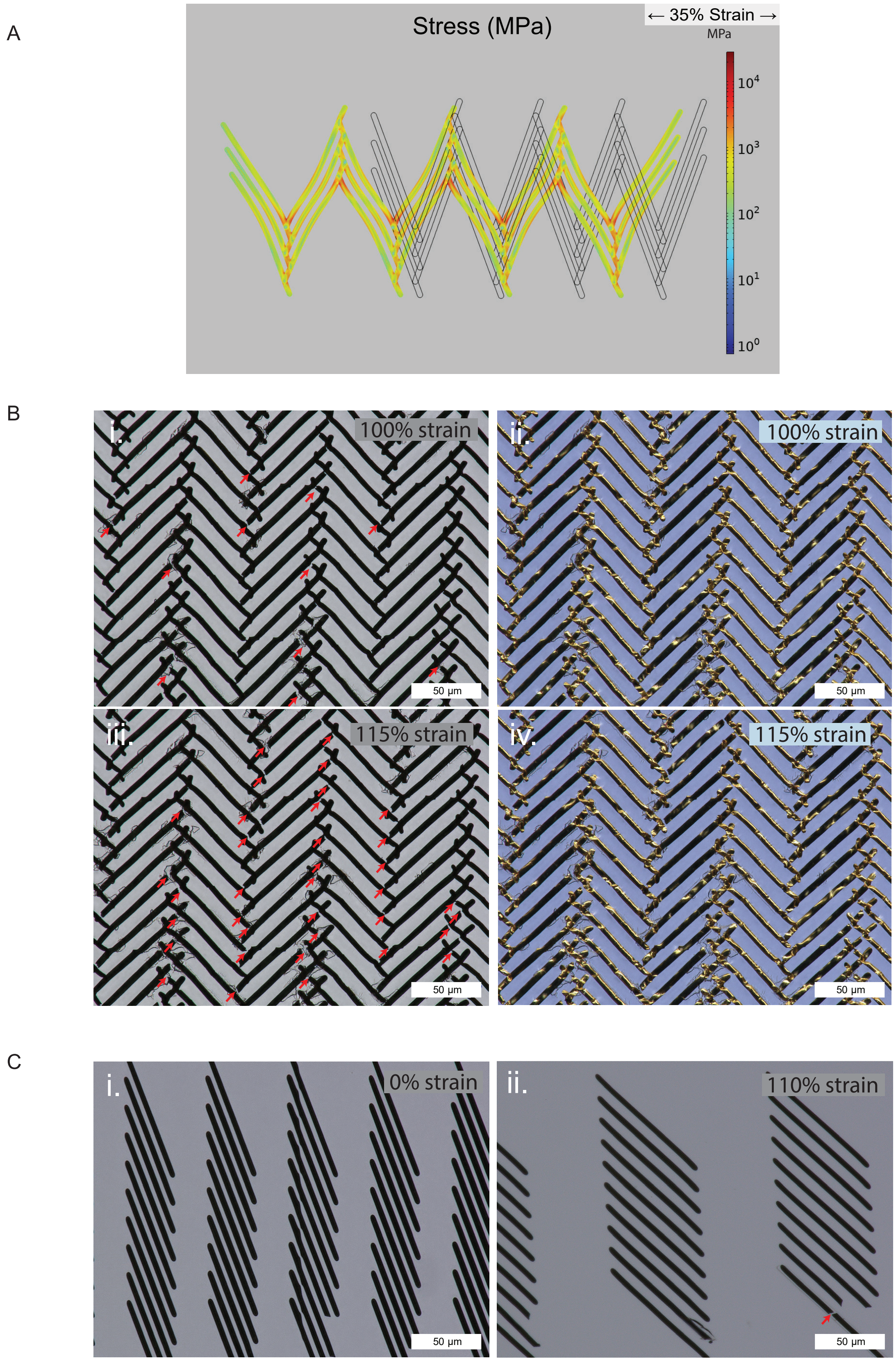

Figure S5: caption on next page

Figure S5: (A) FEA picture showing the concentration of higher stresses around the hinge areas of the herringbone design. (B) Microscope pictures highlighting the apparition of crack around the hinge areas when subject to high strains. i) and ii) both taken at 100% strain, with different lighting to better appreciate the crack formation and wire morphology respectively. iii) and iv) taken at 115%. The red arrows highlight crack locations. (C) As comparison, a similar design with only one layer transfer exhibits close to zero crack at a strain of 120%.

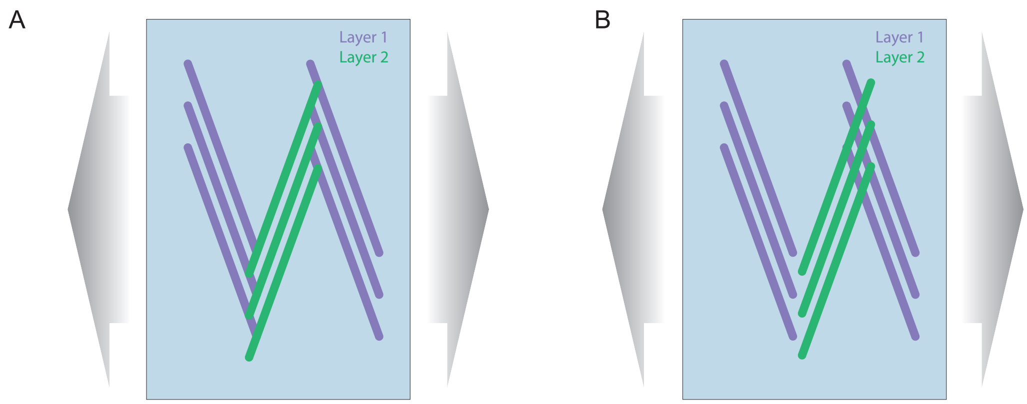

Figure S6: (A) perfectly aligned herrringbone design. (B) misaligned herringbone design, resulting in a loss of conductive properties due to the gap between the two layers.

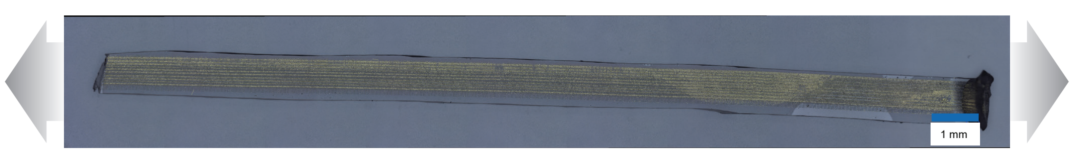

Figure S7: Example of an interconnect from the "robust" design used for tensile testing and electrical characterization (picture taken after testing).