

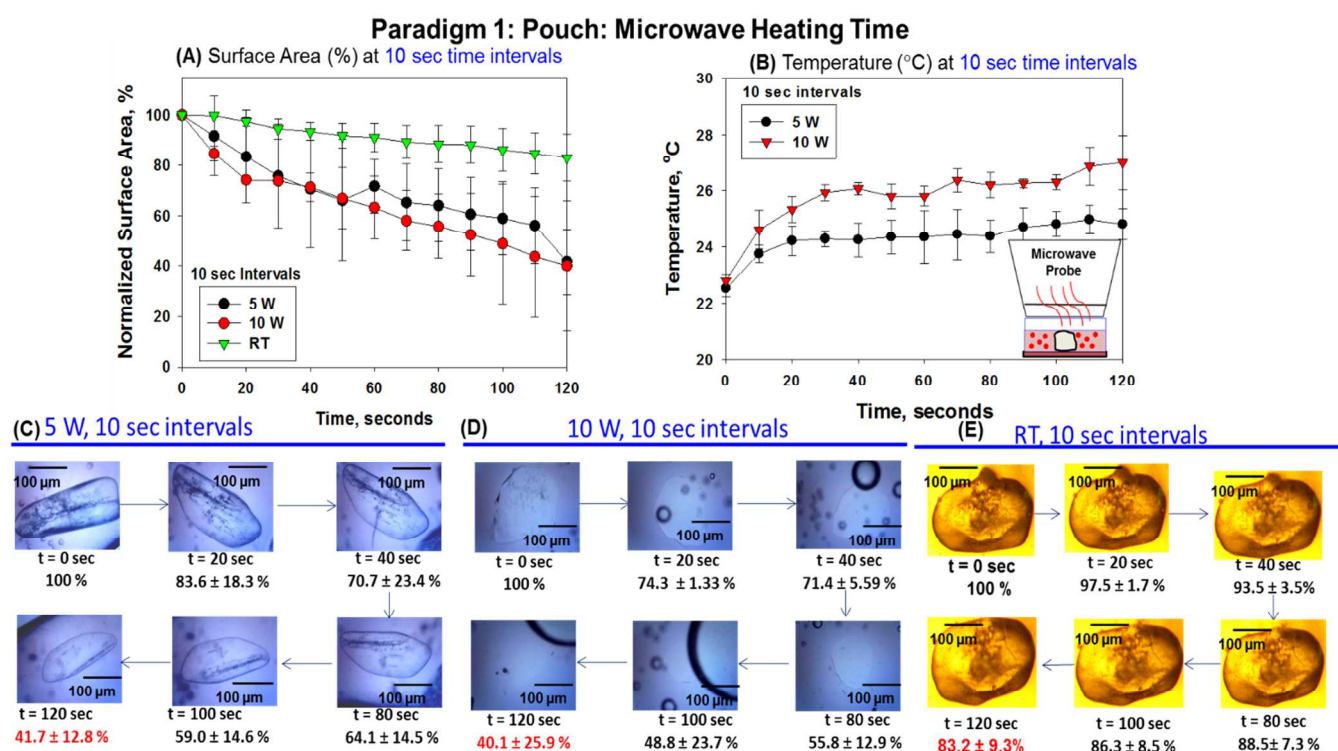
## Microwave Heating of Crystals with Gold Nanoparticles and Synovial Fluid under Synthetic Skin Patches

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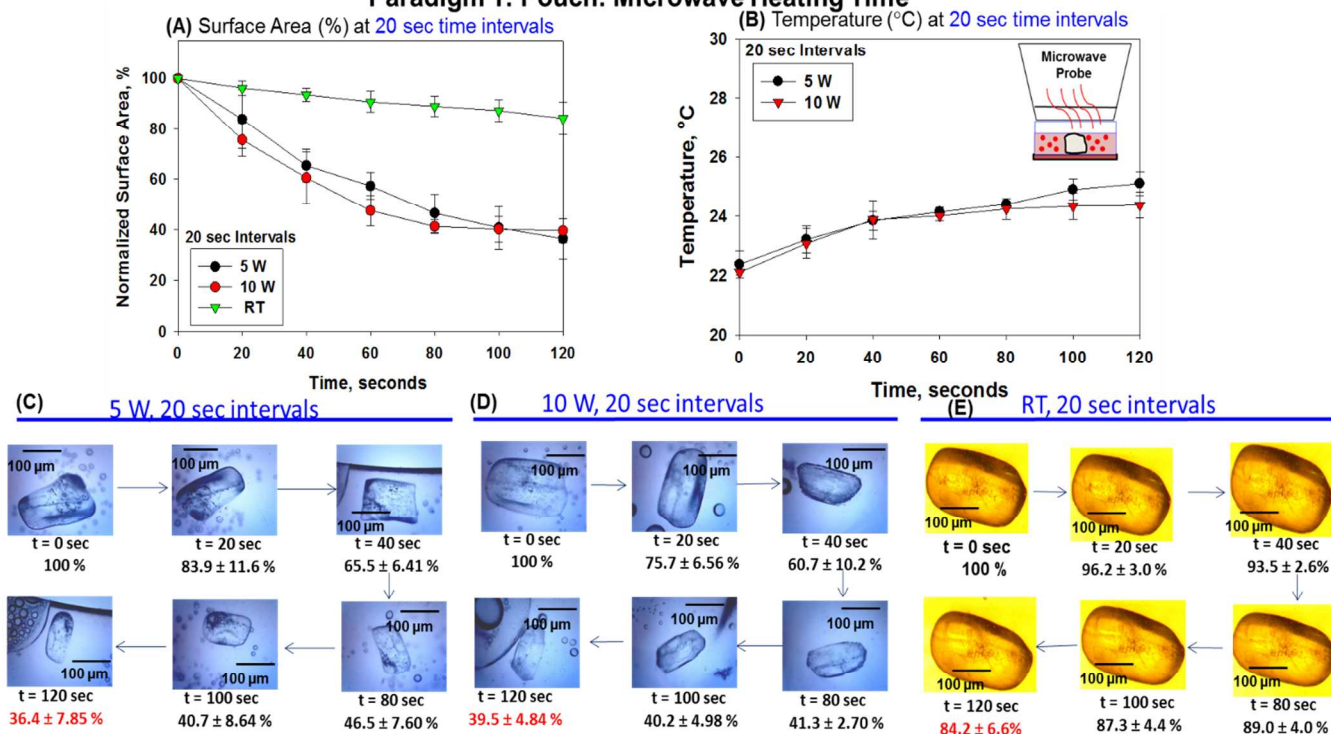
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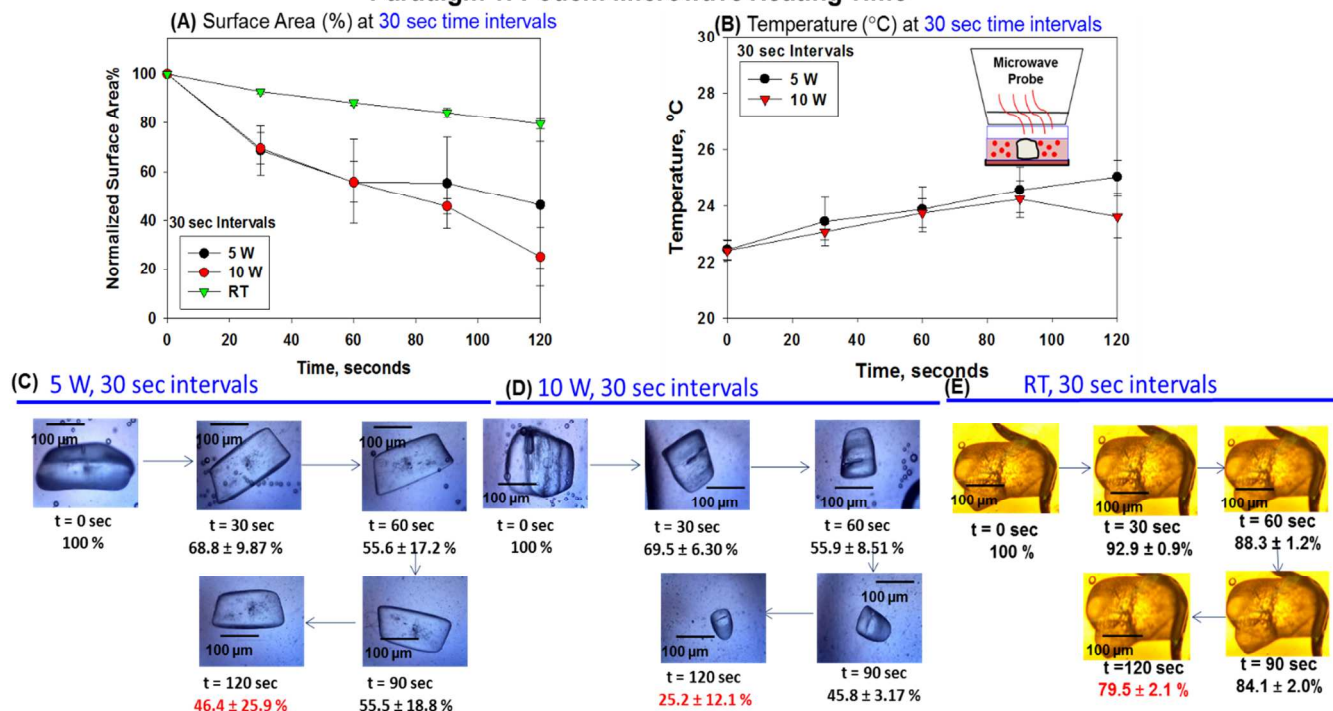
**Figure S1. Paradigm 1: Pouch: Microwave Heating Time. (A)** Percent change in surface area (%) of L-alanine crystals in a plastic pouch for 120 seconds (every 10 seconds) of microwave heating at 5 W and 10 W. **(B)** Temperature (°C) of the plastic pouch for 120 second (every 10 seconds) of microwave heating at 5 W and 10 W. Optical images of L-alanine crystals during microwave heating at 0, 20, 40, 80, 100, and 120 seconds **(C)** at 5 W, **(D)** at 10 W and **(E)** at room temperature. Magnification 40 X.

### Paradigm 1: Pouch: Microwave Heating Time



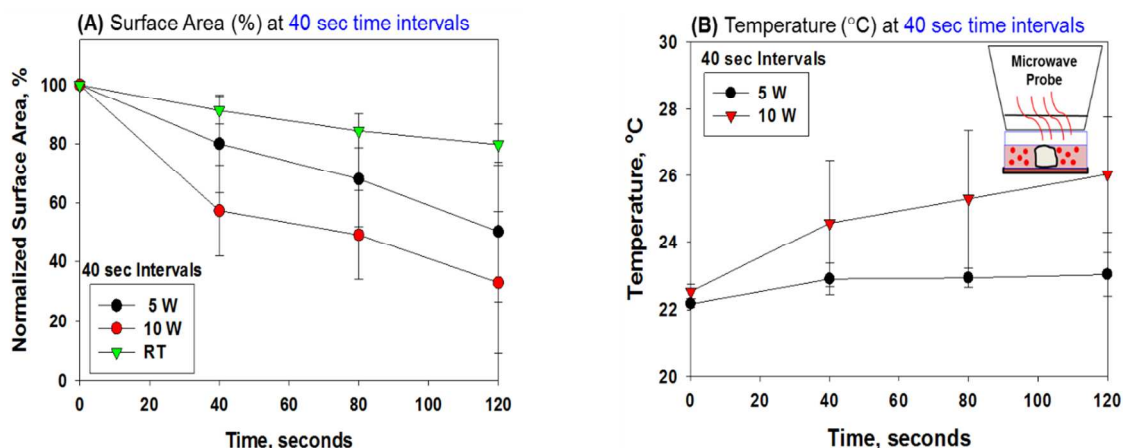
**Figure S2. Paradigm 1: Pouch: Microwave Heating Time. (A)** Percent change in surface area (%) of L-alanine crystals in a plastic pouch for 120 seconds (every 20 seconds) of microwave heating at 5 W and 10 W. **(B)** Temperature (°C) of the plastic pouch for 120 second (every 20 seconds) of microwave heating at 5 W and 10 W. Optical images of L-alanine crystals during microwave heating at 0, 20, 40, 80, 100, and 120 seconds **(C)** at 5 W, **(D)** at 10 W and **(E)** at room temperature. Magnification 40 X.

### Paradigm 1: Pouch: Microwave Heating Time



**Figure S3. Paradigm 1: Pouch: Microwave Heating Time.** (A) Percent change in surface area (%) of L-alanine crystals in a plastic pouch for 120 seconds (every 30 seconds) of microwave heating at 5 W and 10 W. (B) Temperature (°C) of the plastic pouch for 120 second (every 30 seconds) of microwave heating at 5 W and 10 W. Optical images of L-alanine crystals during microwave heating at 0, 30, 60, 90, and 120 seconds (C) at 5 W, (D) at 10 W and (E) at room temperature. Magnification 40 X.

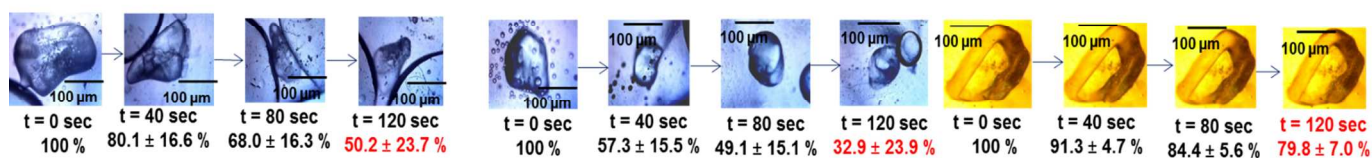
### Paradigm 1: Pouch: Microwave Heating Time



(C) 5 W, 40 sec intervals

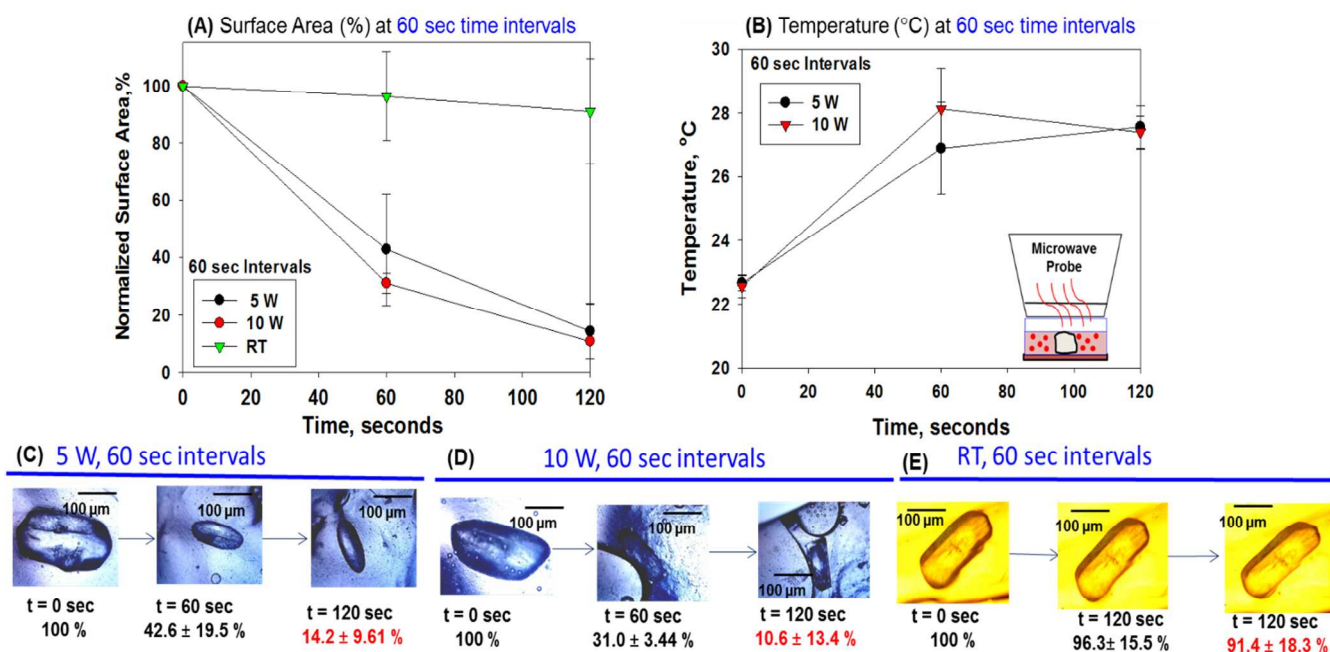
(D) 10 W, 40 sec intervals

(E) RT, 40 sec intervals



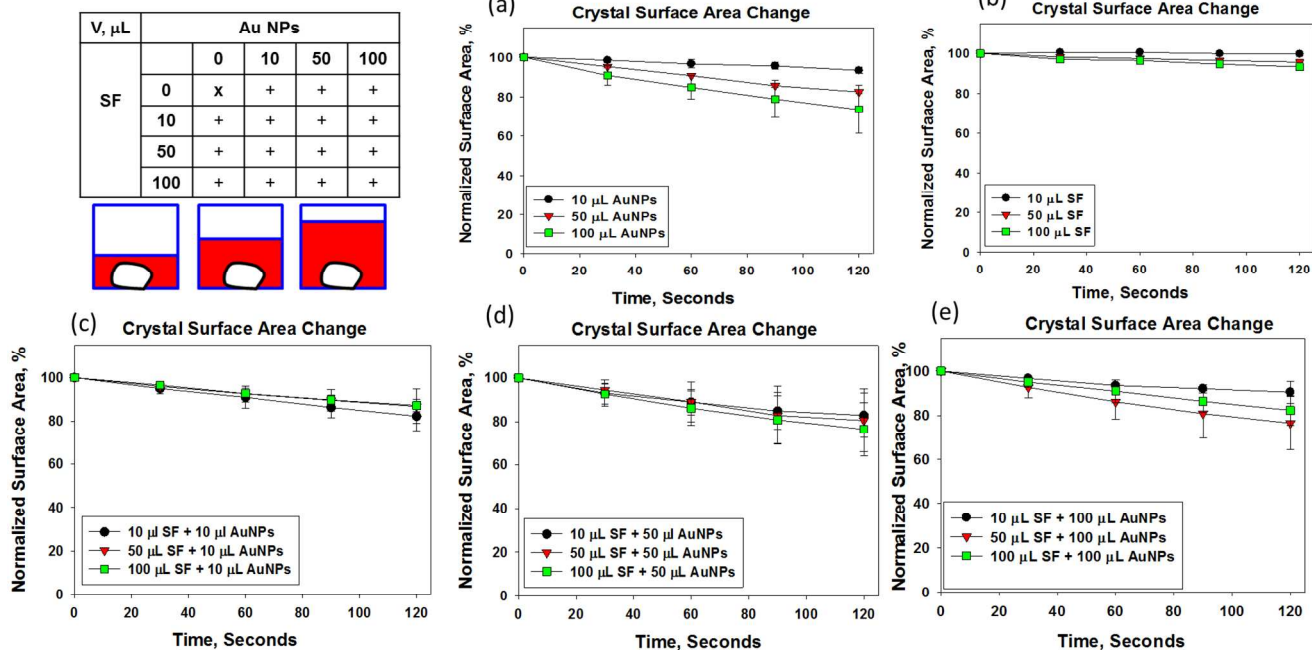
**Figure S4. Paradigm 1: Pouch: Microwave Heating Time.** (A) Percent change in surface area (%) of L-alanine crystals in a plastic pouch for 120 seconds (every 40 seconds) of microwave heating at 5 W and 10 W. (B) Temperature (°C) of the plastic pouch for 120 second (every 40 seconds) of microwave heating at 5 W and 10 W. Optical images of L-alanine crystals during microwave heating at 0, 40, 80, and 120 seconds (C) at 5 W, (D) at 10 W and (E) at room temperature. Magnification 40 X

### Paradigm 1: Pouch: Microwave Heating Time

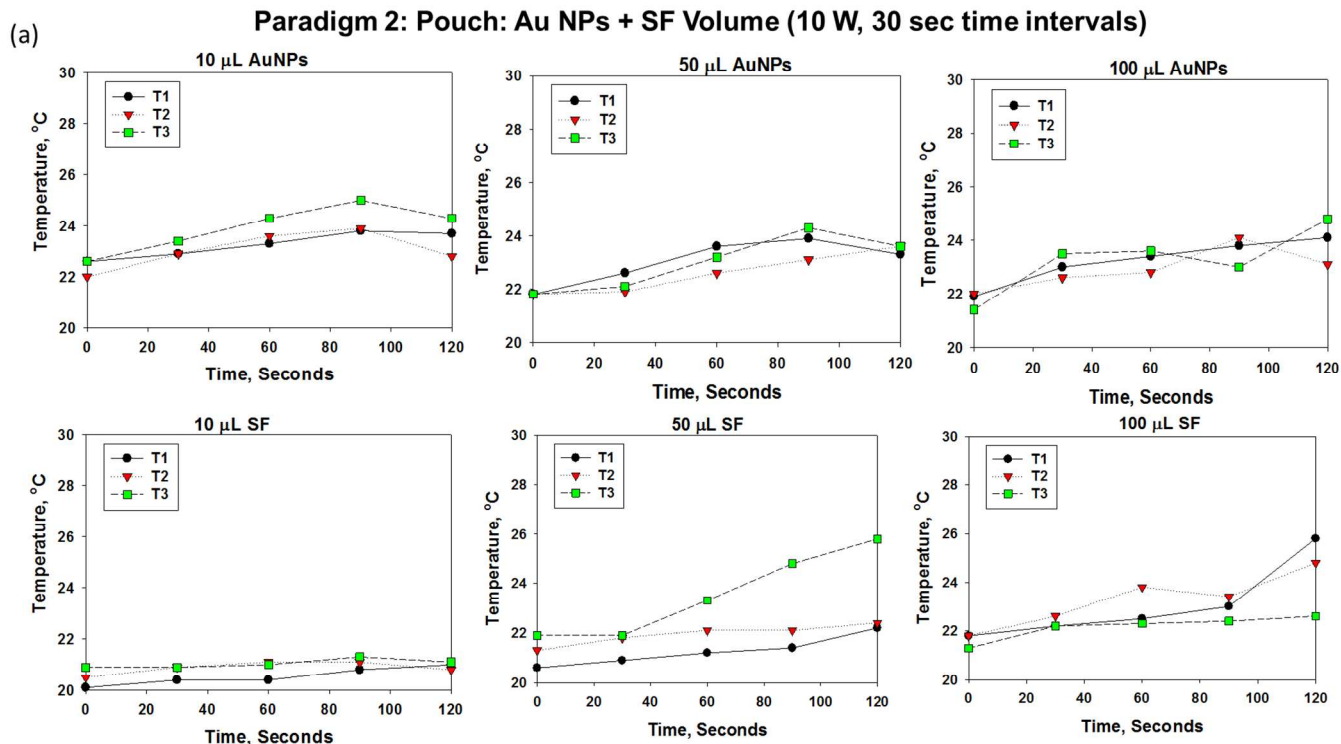


**Figure S5. Paradigm 1: Pouch: Microwave Heating Time.** (A) Change in surface area of L-alanine crystals in a plastic pouch during 120 sec of microwave heating at 5 W and 10 W and at 60 sec time intervals. (B) Temperature of the plastic pouch during 120 sec of microwave heating at 5 W and 10 W and at 60 sec time intervals. Optical images of L-alanine crystals during microwave heating at 60 sec intervals (C) at 5 W, (D) at 10 W and (E) at room temperature. Magnification 40 X.

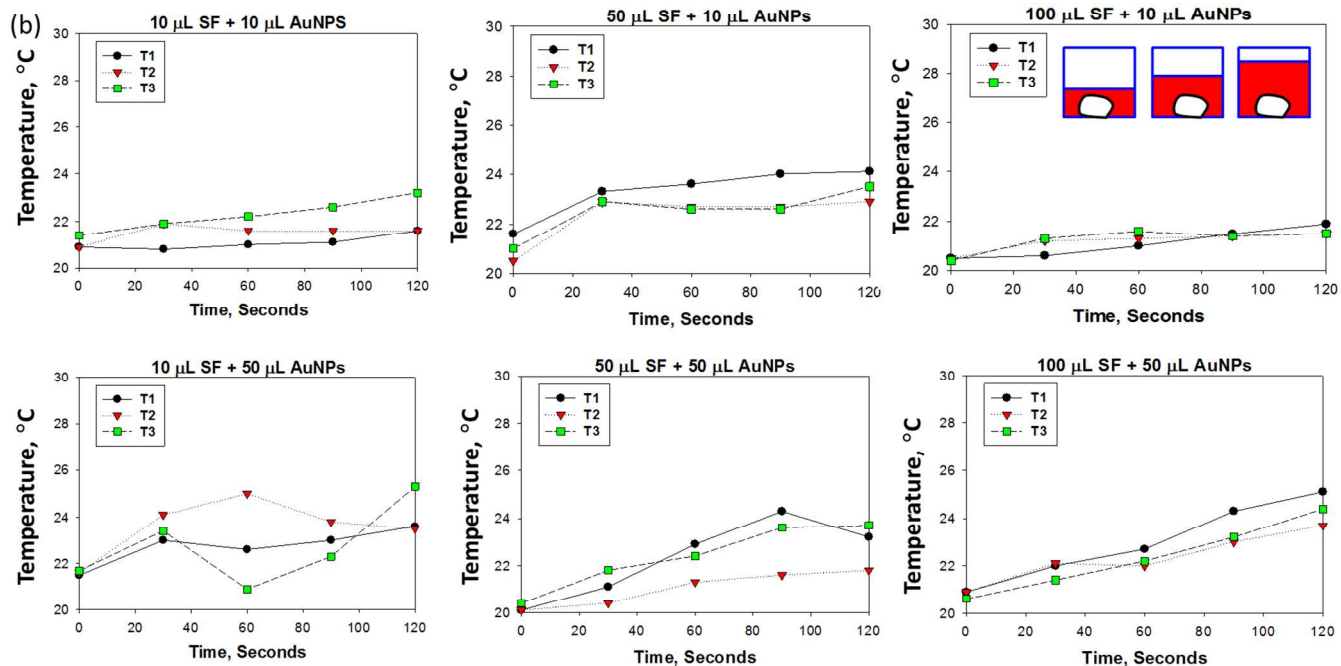
**Paradigm 2: Pouch: AuNPs + SF Volume: RT at 30 sec time intervals**



**Figure S6. Paradigm 2: Pouch: Au NPs + Synovial Fluid (SF) Volume (V; RT, 30 sec time intervals).** Summary of data collected from three different paradigm 2 experiments. Percent change in surface area (%) of L-alanine crystals in a plastic pouch for 120 sec (at 30 sec time intervals, room temperature). Data is presented as the mean  $\pm$  standard deviation of the three different experiments. Table shows the fifteen experimental groups used in this study at room temperature (a) 1-3. Au NP (10, 50, or 100  $\mu$ L) alone, (b) 4 - 6. SF (10, 50, or 100  $\mu$ L) alone, and 7 - 15. SF (10, 50, or 100  $\mu$ L) + Au NPs (10, 50, or 100  $\mu$ L).

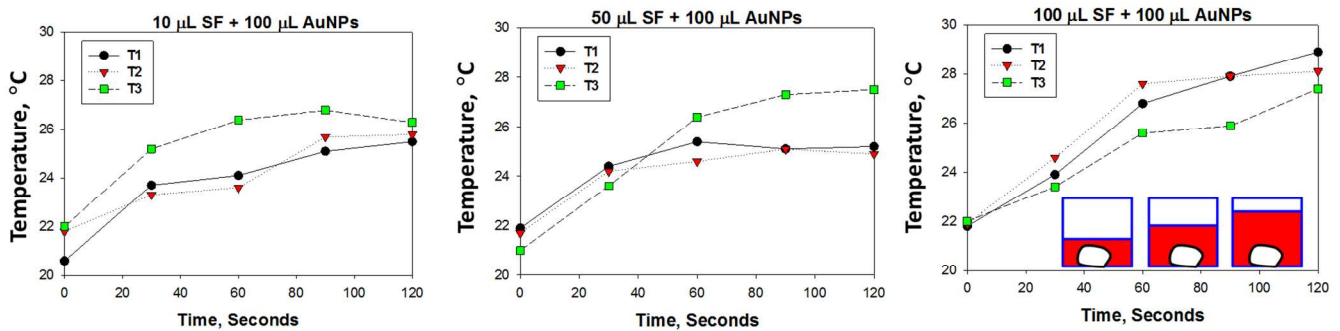


**Paradigm 2: Pouch: Au NPs + SF Volume (10 W, 30 sec time intervals)**



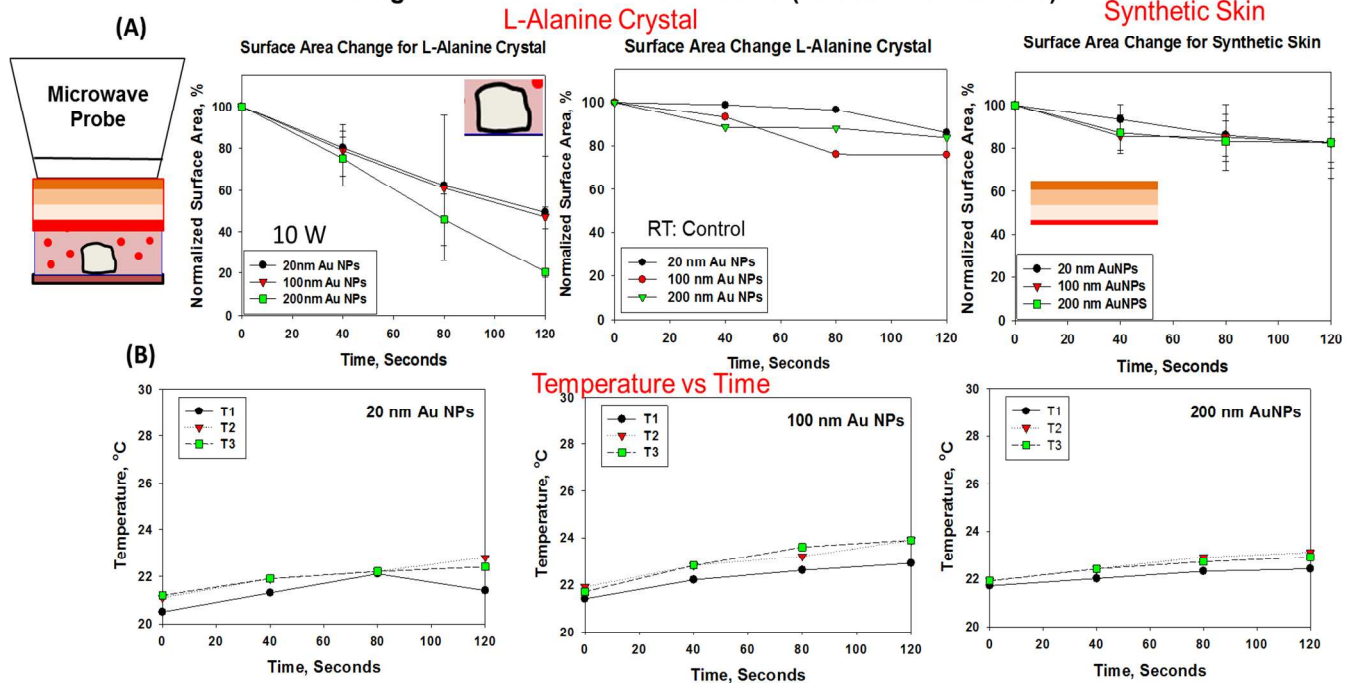
**Figure S7.** Pouch: AuNPs + SF Volume: 10 W, 30 sec. Change in temperature of the plastic pouch for (a) AuNPs and synovial fluid (SF) only and (b) various mixtures of AuNPs and synovial fluid (SF) during 120 sec of microwave heating at 10 W and at 30 sec time intervals. T1, T2 and T3 indicates three different experiments: trial 1, 2 and 3, respectively.

**Paradigm 2: Pouch: AuNPs + SF Volume (10 W, 30 sec time intervals)**



**Figure S7. Paradigm 2: Pouch: AuNPs + Synovial Fluid (SF) Volume (V; 10 W, 30 seconds).** Change in temperature (%) of the plastic pouch containing various mixtures of AuNPs and SF for 120 seconds (every 30 seconds) of microwave heating at 10 W. Treatment groups: 10ul SF + 100ul AuNPs, 50ul SF + 100ul AuNPs, and 100ul SF + 100ul AuNPs. T1, T2, and T3 indicates three different experiments: Trial 1, 2, and 3, respectively.

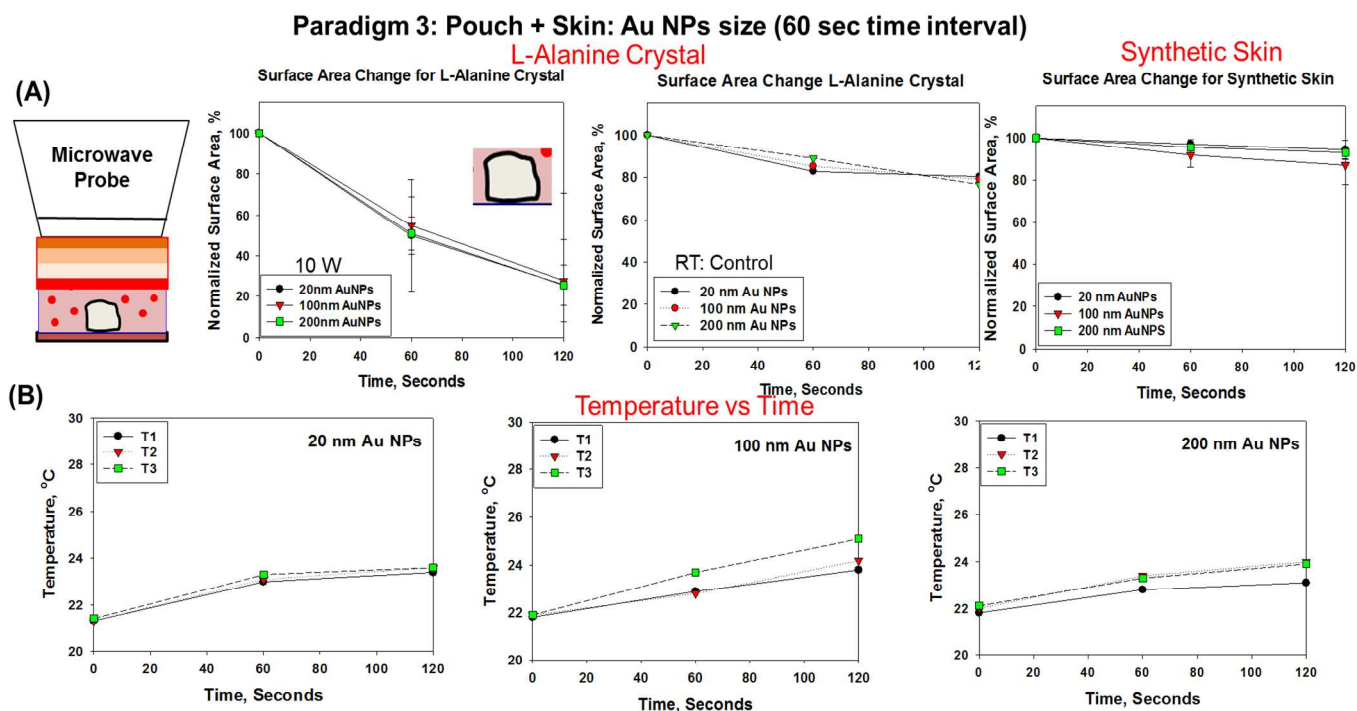
**Paradigm 3: Pouch + Skin: Au NPs size (40 sec time intervals)**



**Figure S8. Paradigm 3: Pouch + Synthetic Skin Patch: Au NPs size (10 W, 40 seconds).** Summary of data collected from three different experiments. **(A)** Percent change in surface area (%) of L-alanine crystals in a plastic pouch through synthetic skin patch at 10 W and at room temperature. **(B)** Percent change in surface are (%) of the synthetic skin for 120 seconds (every 40 seconds) of microwave heating at 10 W. Data is presented as the mean  $\pm$  standard deviation of the three different experiments. The sizes of Au NPs used in these trials are 20

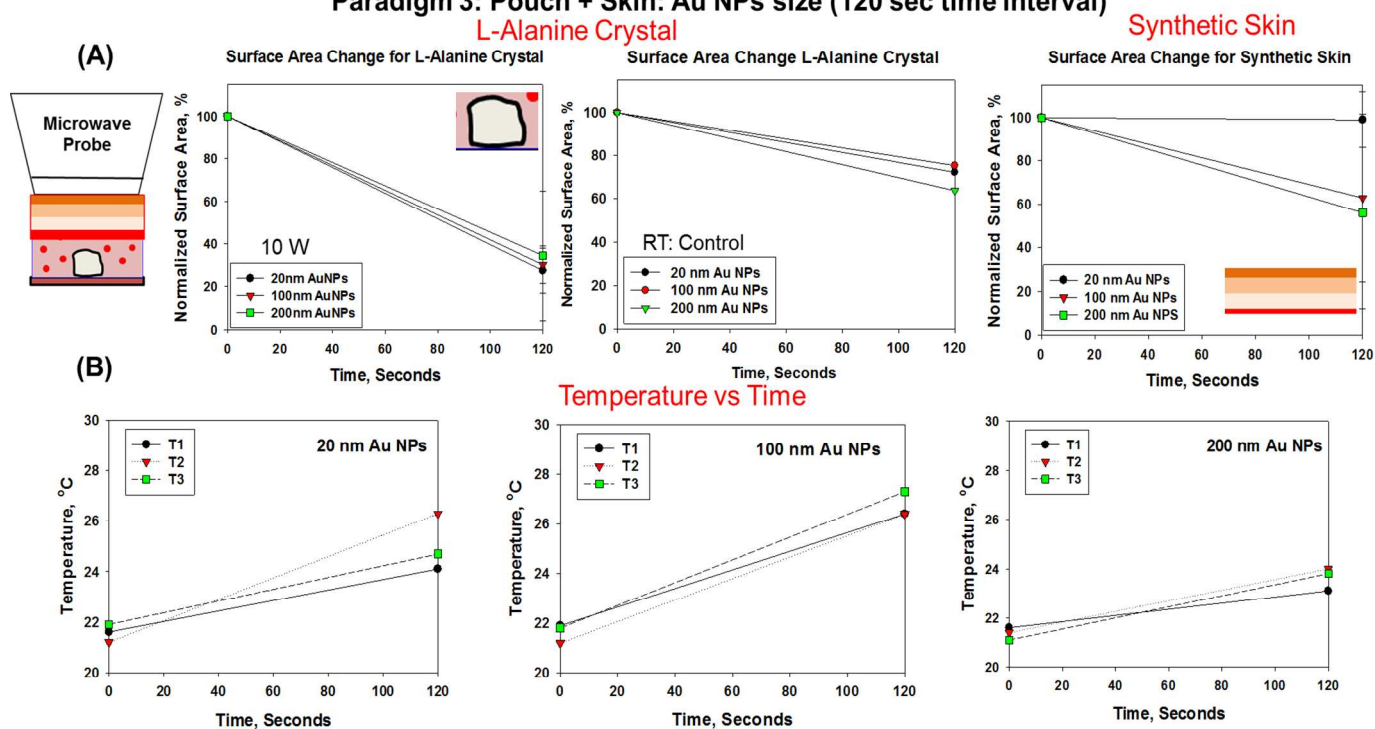


nm, 100 nm, and 200 nm. T1, T2, and T3 indicates three different experiments: Trial 1, 2, and 3, respectively.



**Figure S9. Paradigm 3: Pouch + Synthetic Skin Patch: Au NPs size (10 W, 60 seconds).** Summary of data collected from three different experiments. **(A)** Percent change in surface area (%) of L-alanine crystals in a plastic pouch through synthetic skin patch at 10 W and at room temperature. **(B)** Percent change in surface are (%) of the synthetic skin for 120 seconds (every 60 seconds) of microwave heating at 10 W. Data is presented as the mean  $\pm$  standard deviation of the three different experiments. The sizes of Au NPs used in these trials are 20 nm, 100 nm, and 200 nm. T1, T2, and T3 indicates three different experiments: Trial 1, 2, and 3, respectively.

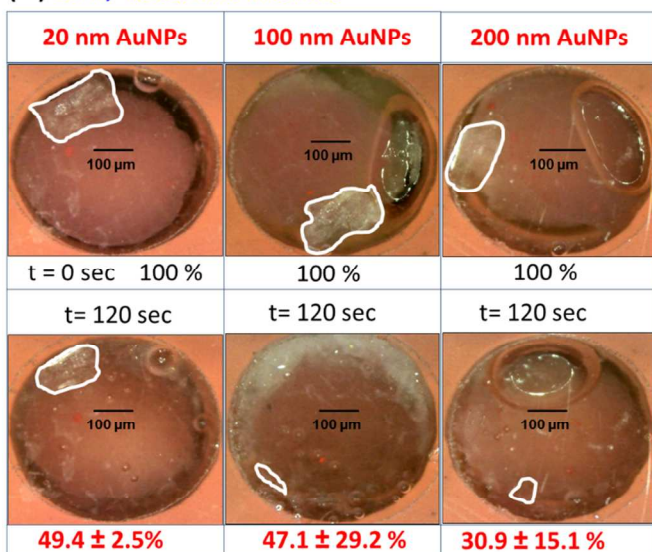
### Paradigm 3: Pouch + Skin: Au NPs size (120 sec time interval)



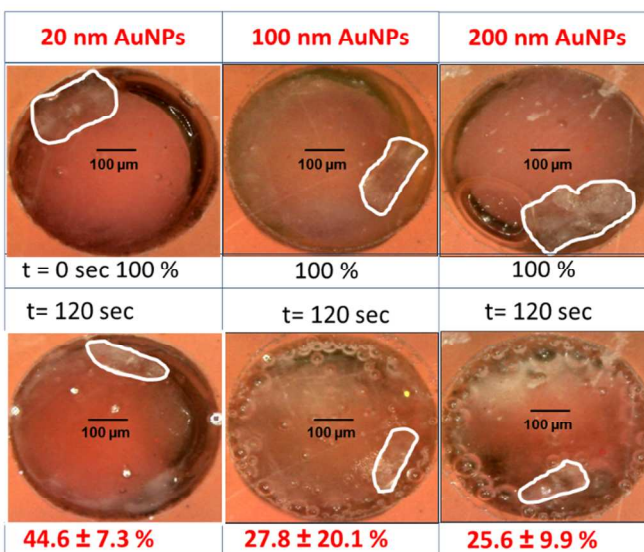
**Figure S10. Paradigm 3: Pouch + Synthetic Skin Patch: Au NPs size (10 W, 120 seconds).** Summary of data collected from three different experiments. **(A)** Percent change in surface area (%) of L-alanine crystals in a plastic pouch through synthetic skin patch at 10 W and at room temperature. **(B)** Percent change in surface are (%) of the synthetic skin for 120 seconds of microwave heating at 10 W. Data is presented as the mean  $\pm$  standard deviation of the three different experiments. The sizes of Au NPs used in these trials are 20 nm, 100 nm, and 200 nm. T1, T2, and T3 indicates three different experiments: Trial 1, 2, and 3, respectively.

Paradigm 3: Pouch + Skin: AuNPs size (10 W, 40 and 60 sec time intervals)

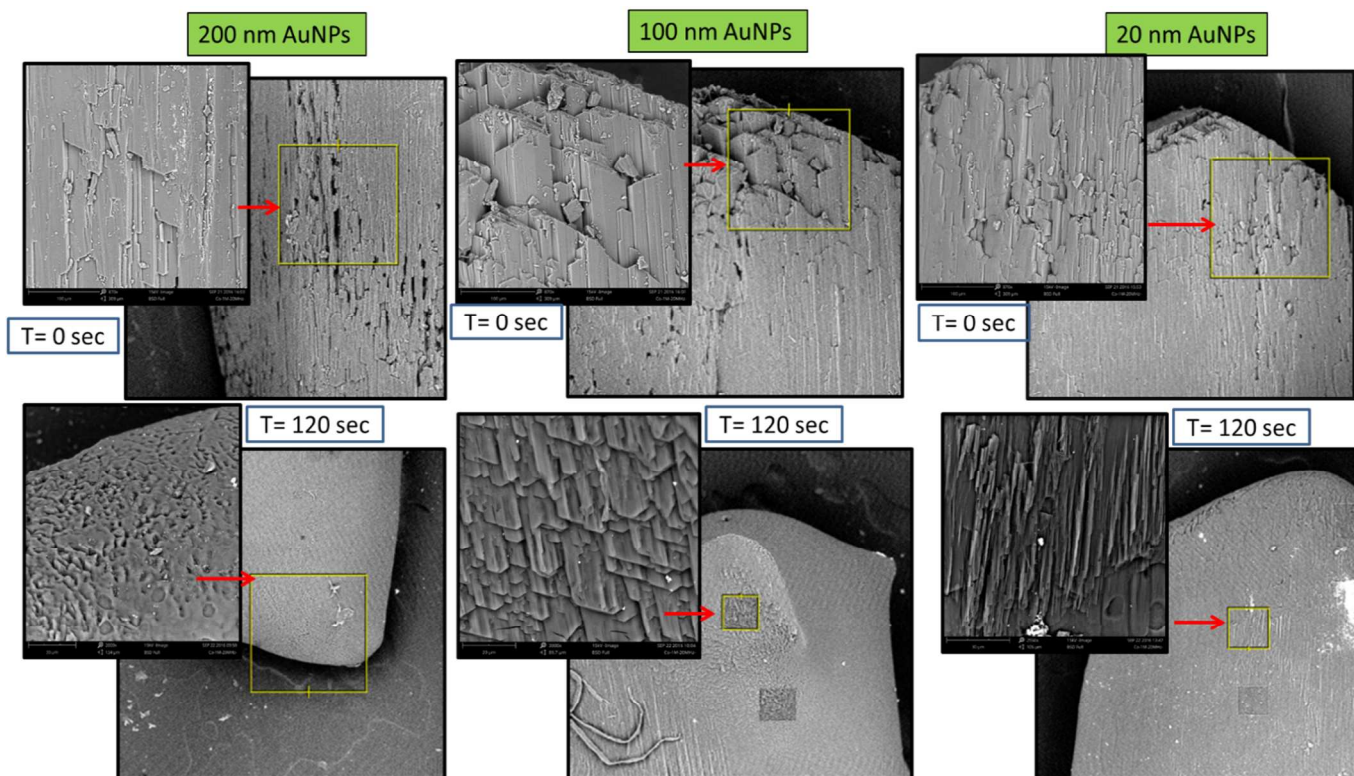
(A) 10 W, 40 sec time intervals



(B) 10 W, 60 sec time intervals



**Figure S11. Paradigm 3: Pouch + Skin: AuNPs size (10 W, 40 and 60 seconds).** (A) Real-color pictures of the synthetic skin patch and L-alanine crystals before and after microwave heating for 120 seconds (every 40 seconds) at 10 W. (B) Percent change in surface area (%) of L-alanine crystals in a plastic pouch through synthetic skin patch after microwave heating for 120 seconds (every 60 seconds) at 10 W. Data is presented as the mean ± standard deviation of the three different experiments. The sizes of the AuNPs used in these trials are 20 nm, 100 nm, and 200 nm.



**Figure S12.** SEM images of L-alanine crystals exposed to the MAMAD technique under synthetic skin tissue in pouch filled with Au NPs sizes 20 nm, 100 nm and 200 nm, shown before exposure images at 0 seconds and after exposure at 120 seconds. Microwave power set at 10 W with 20 seconds time intervals.