Thermal analysis of Micro Needles

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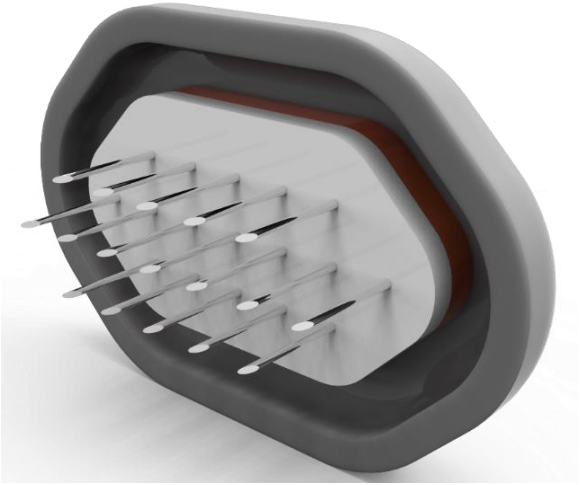
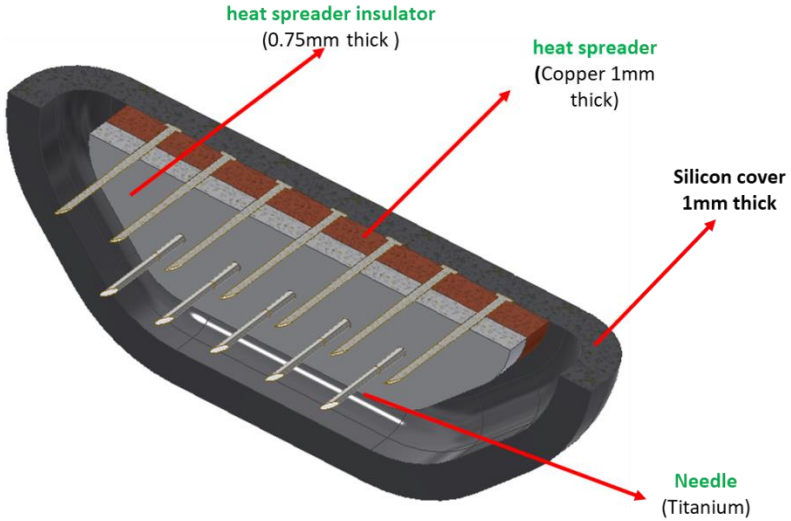
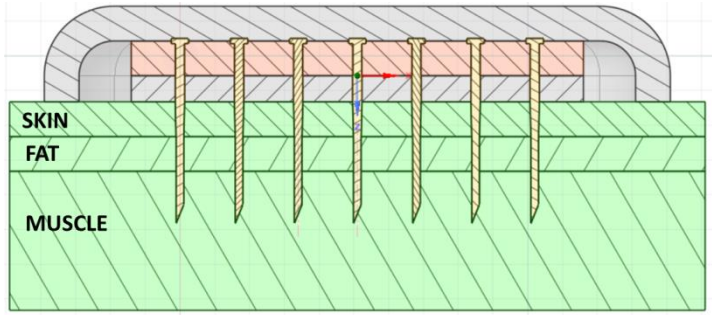


ISOMETRIC VIEW



Objective :

- The objective of this study is to determine the heat generation requirement from a **heat trace** which is between the **copper** and the **silicon cover**.
- To achieve a uniform temperature distribution across all needles.
- Various iterations were performed as follows:
- With and without parylene coating on the needle.
- With different thicknesses of the Insulator.
- With uniform and different zones of heating.

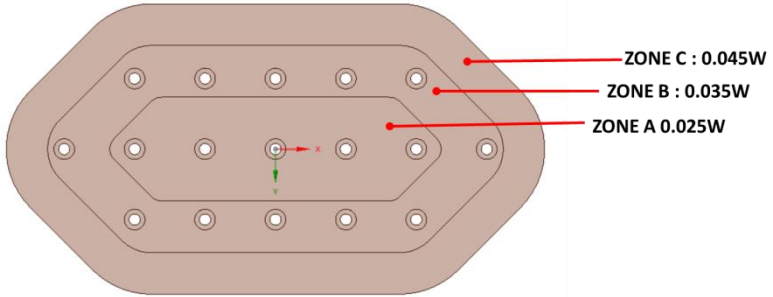


SECTIONAL VIEW

Thermal analysis of Micro Needles

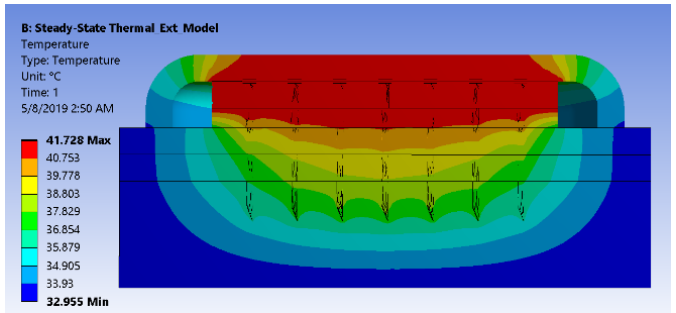
Conditions :

- Initial temperature of the system is 33°C.
- **Variable heat flow rate** is provided on top of the **copper**.
- Convection of 5W/m²°C with ambient temperature of 22 °C is provided on faces marked yellow.
- Side temperature of the **skin muscle** and fat are provided with an adiabatic temperature of 33 °C

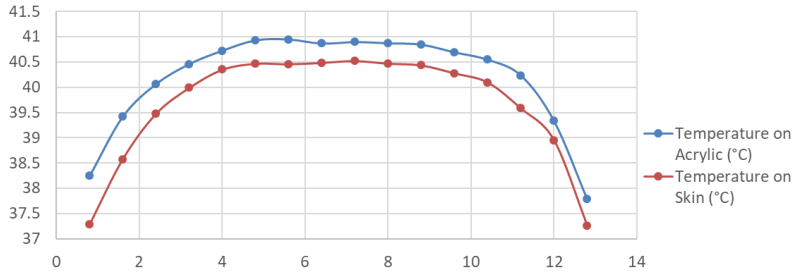


Conclusion:

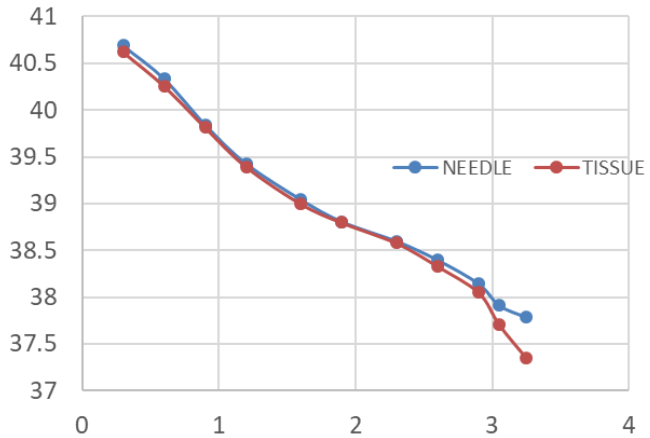
The parylene model or differential insulator thickness model did not fetch good results. But With differential zones, we are able to get lower differences on the skin temperatures. The difference in heat generation had to be greater to achieve a uniform temperature.



0.025W+0.035W+0.045W HEAT INPUT: TEMP. DISTRIBUTION



Temperature distribution vs distance along the Acrylic and skin interface



Temperature distribution vs distance along the needle