BREAKING BARRIERS

SMARTER INNOVATION IN WOUND MANAGEMENT

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Introduction

Wound care remains largely manual despite rising healthcare costs and looming resource shortages by 2030. Digital tools can improve monitoring, standardize care, and enable early infection detection, yet integration into clinical workflows faces resistance. We propose embedding flexible electronics into wound dressings and explore key challenges in sensor integration, focusing on accuracy, comfort, and usability. **This study explores key design choices and challenges in sensor integration.**

Holst Centre Portfolio

At Holst Centre, TNO, we are developing and integrating flexible electronics into advanced wound care systems to explore sensor technologies for monitoring, early infection detection, and promoting accelerated healing.

Physical
Thermal. Electrical,Optical,Pressure

Chemical & Multisensor
pH Uric Acid

Biological + Microfluids
Bacteria Species, Biofilms

Functionality & Integration

While compact, sensitive, and cost-effective sensors are widely available, their integration into wound dressings poses significant challenges. Material properties—such as thermal insulation and fluid absorption—affect sensor accuracy and response time. As sensing shifts toward biomarker detection, maintaining reliability and functional integration becomes increasingly complex.

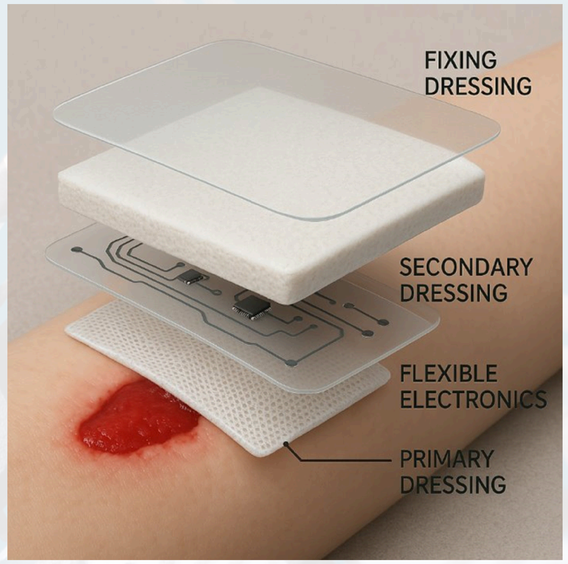
Conclusion

- There is an urgent need to shift healthcare toward digitally supported solutions, especially in complex areas like wound management.
- Integrating sensor modalities—physical, chemical, and more—into these environments poses technical challenges that demand careful validation for accuracy and sensitivity.
- Flexible electronics offer a promising path for embedding sensors into existing dressings, enabling smoother integration into current clinical workflows.

The project is co-funded by the European Union under grant agreement 101112109. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Chips Joint Undertaking. Neither the European Union nor the granting authority can be held responsible for them. This project is supported by the Chips Joint Undertaking and its members under grant agreement 101112109 including top up funding by Netherlands, Austria, Germany, Spain, Finland, France, Latvia, Poland, and Sweden. This work also received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

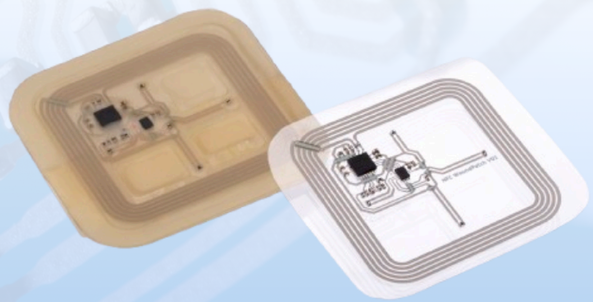
Sensor Maturity

Integration Challenges



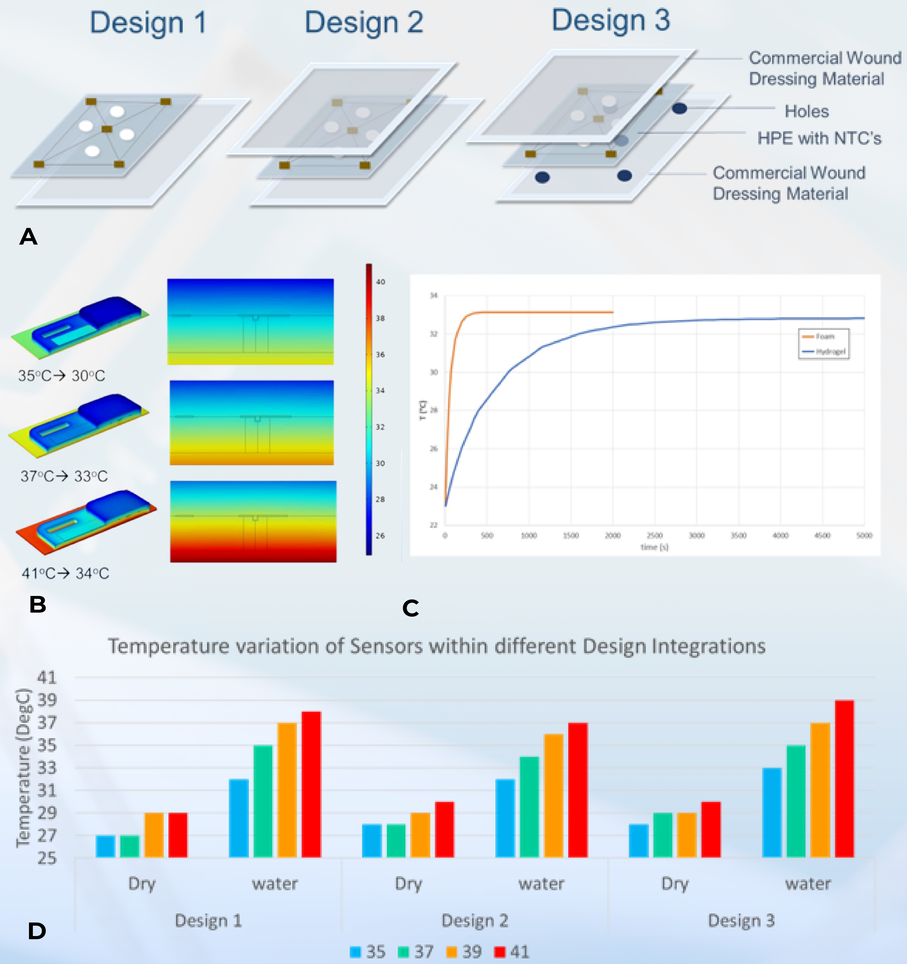
Smart Wound Care

Seamless integration with Hybrid Printed Electronics



- **Flexible, Stretchable Electronics**
- **Integration within current dressing systems.**
- **Low Cost & Scalable.**

Results



Figures A-D to show results of temperature sensor accuracy and sensitiviity when integrated in advanced wound dressings. A) Schematic diagrams to show the build-up of potential smart wound care dressings. B) COMSOL Simulations for the thermal transference of temperature through foam material used within wound care. C) Line graph to illustrate the response time variation for temeprature readings within different advance wound dressing material. D) Bar graphs to show the impact of water absorption on temperature readings within wound dressing material.

Advanced Wound Care → NWPT (Negative Wound Pressure Therapy) → Antimicrobial Dressings → Artificial Intelligence → **Digital Tools**