Twinned Modelling – Characterisation (MODA-CHADA) Solutions for Electronic and Energy Materials: from H2020 MMAMA and NanoBat to M-ERA.NET ULTCC6G_Epac and I4BAGS Projects

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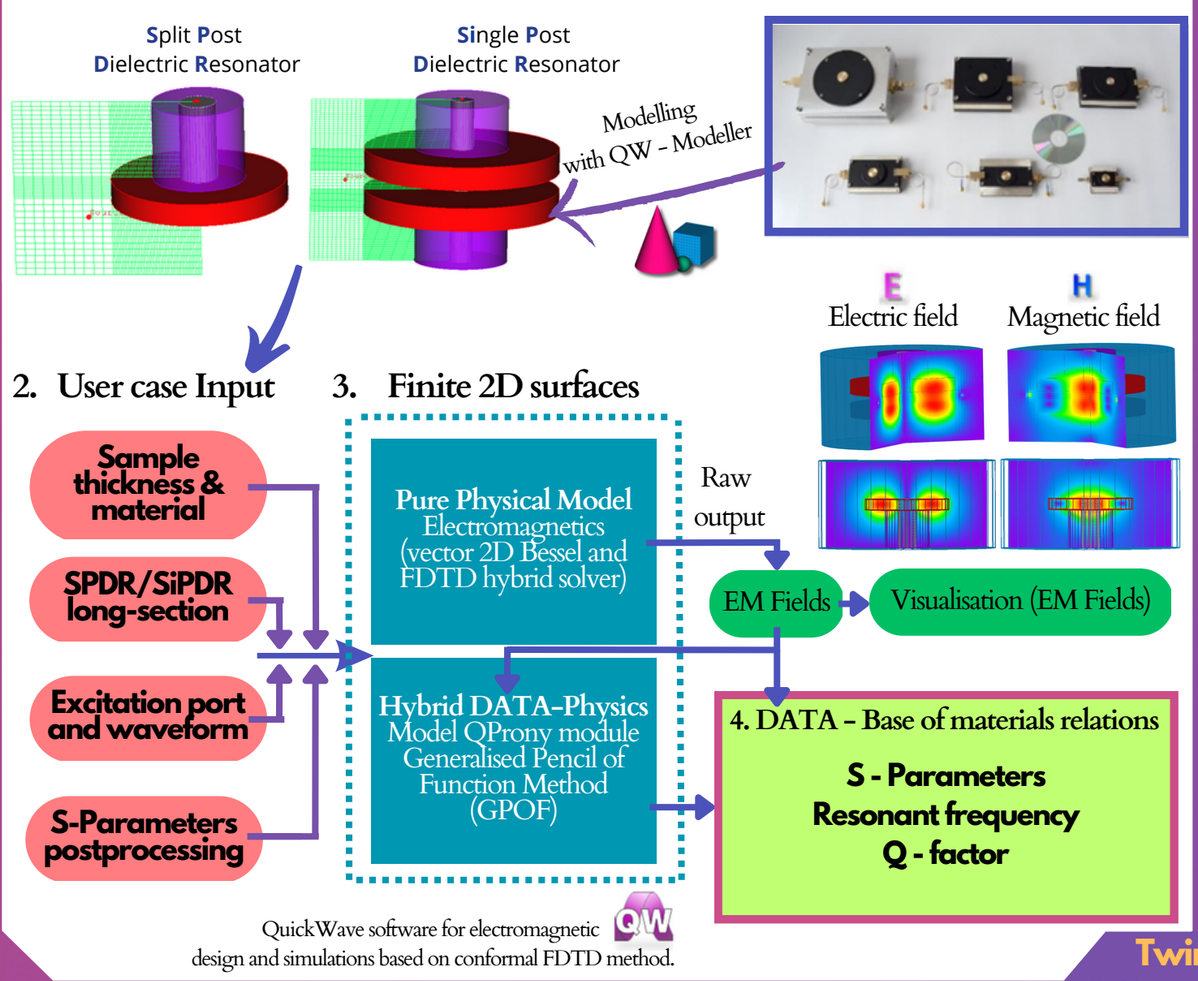
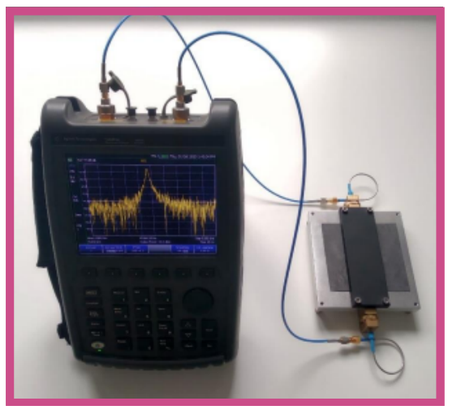
MOdelling DAta workflow

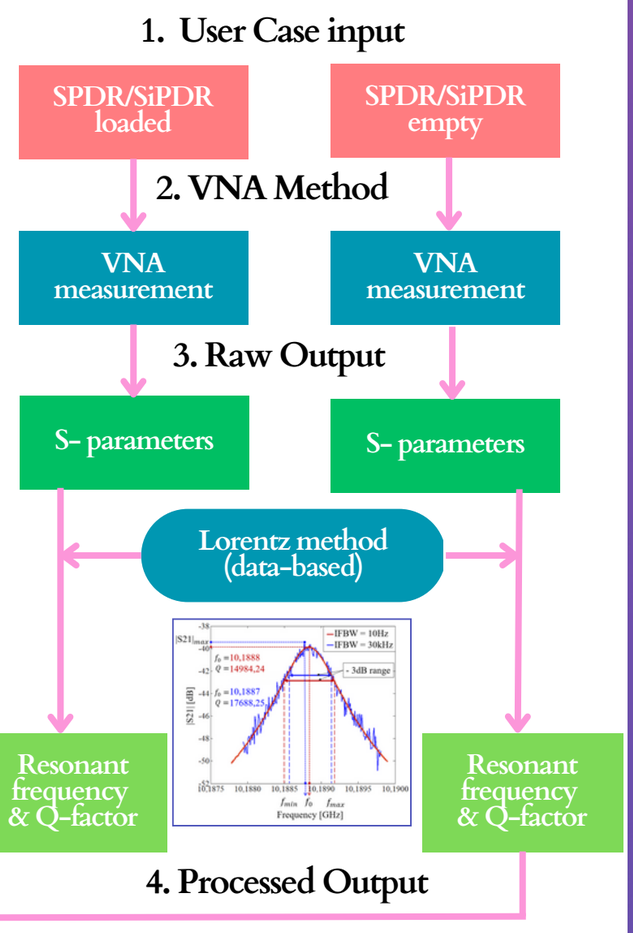


QuickWave software for electromagnetic design and simulations based on conformal FDTD method.

CHaracterisation DAta workflow



QWED's SiPDR and Keysight's FieldFox measurement setup



5. SPDR/SiPDR Method

Description of the set of standard SPDRs manufactured by QWED

Nominal frequency [GHz]	Minimum size of sample [mm] (diameter D or square D x D)	Maximum thickness of sample [mm]	Maximum width of the sample in standard version
1.1	120	6.00	150
1.9	70	4.00	100
2.5	55	3.10	100
5.1	30	1.95	90
10	22	0.95	90
15	14	0.60	40

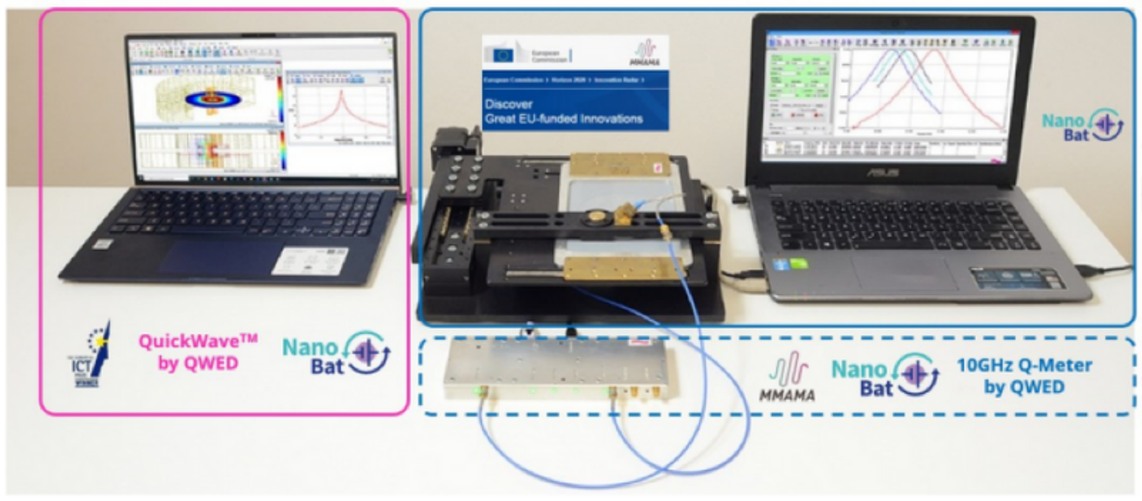
Typical ranges of applications of SPDRs and SiPDRs

	Conductivity [1/(Ωm)]	Resistivity [Ω cm]	Surface resistivity [Ω/sq]
Range of SPDR applications	$2 \cdot 10^{-3}$ to 0.5	from $2 \cdot 10^{2}$ to $5 \cdot 10^{4}$	from $2 \cdot 10^{3}$ to 10^{7}
Range of SiPDR applications	0.1 to 10^{6}	from 10^{-4} to 10^{1}	from 10^{-1} to $2 \cdot 10^{4}$

Twinned MODA + CHADA

...from H2020 MMAMA and NanoBat

NanoBat aims to develop a novel RF-nanotechnology toolbox for quality testing of Li-ion and beyond Lithium batteries with the potential to redefine battery production in Europe and worldwide. A particular focus will be testing and quantifying the electrical processes at the SEI, which are responsible for battery performance and safety, but difficult to characterise and optimise. As SEI formation amounts to one thrid of battery production costs, the project will reduce such costs significantly and hence benefit the evolving clean energy and e-mobility transition in Europe.

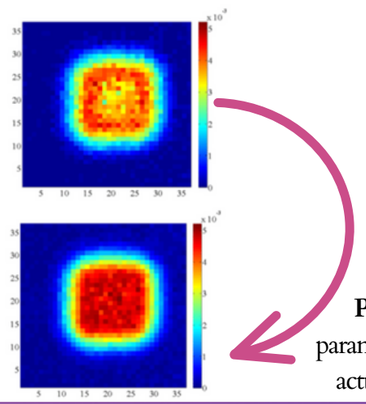


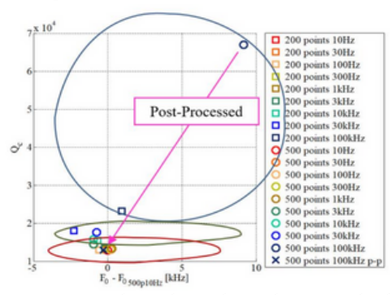
Implementation in the form of surface scanner for GHz-imaging of electronic and battery materials - Finalist of the European Innovation Radar Prize 2021.

A photo of the imaging system built of the 2D SPDR scanner

Measurement

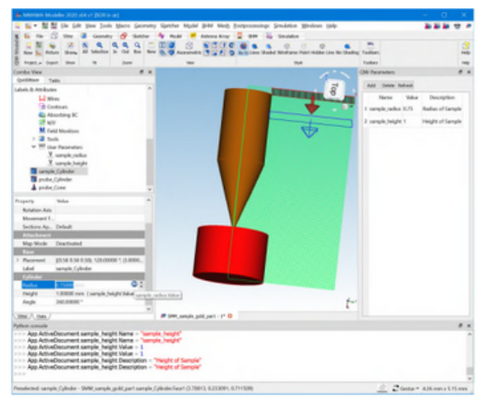
Loss tangent map of a 15 mm x 15 mm laminate SUT





Post-processed results reduce the spread of material parameters (compared to raw measurements), and reveal the actual losses (otherwise underestimated due to the noise)

The aim of this project is to accelerate the development of high efficiency cells and to have measures to predict performances in early stages of prototype production. Where process monitoring of materials with nanostructures is necessary, a dielectric resonator is used to translate insights from scanning microwave microscope measurements to fabrication environments.

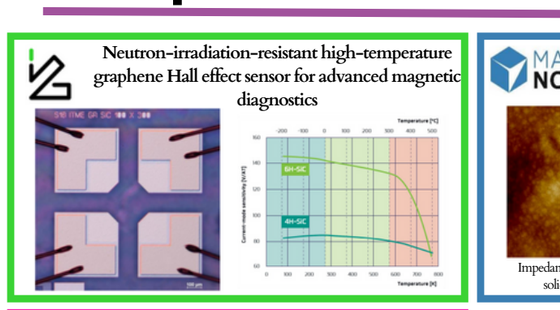


licence-free CAD modellerfocus on User Cases relevant to SMM, dielectric resonator, and coaxial probe material measurements.

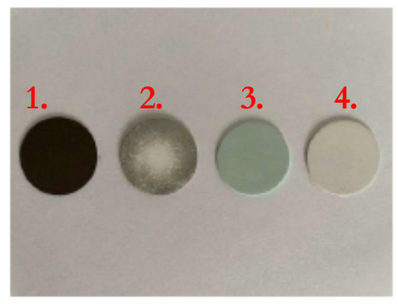
...to M-ERA.NET ULTCC6G_Epac and I4BAGS Projects

The I4BAGS project aims to develop innovative processing and characterisation solutions for microelectronics and battery applications. Driven by topical challenges in communication and energy management, and supported by large industrial demand for innovation.

I4BAGS Website



ULTCC6G_EPac



ULTCC Materials samples under investigation

The main objective of the ULTCC6G_EPac is to develop novel functional materials based on advanced multilayer technology (ULTCC), characterise their properties (e.g. dielectrical) and to demonstrate and validate the telecommunication devices based on the ULTCC6G_EPac.

Sample name	Thickness [mm]	Dielectric constant	Loss tangent (±3%)
Sample 1	0.485 ± 0.015	5.40 ± 2.5%	0.00200 ±3%
Sample 2	0.64 ± 0.030	6.52 ± 4%	0.00233 ±3%
Sample 3	0.6 ± 0.030	5.12 ± 4%	0.00195 ±3%
Sample 4	0.55 ± 0.020	4.48 ± 3%	0.00328±3%

Acknowledgement

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