The main objective of the project „High Quality European GaN-Wafer on SiC Substrates for Space Applications" (EuSiC) was the development of high quality semi-insulating 3 inch SiC-substrates, which are superior to that available from non-European sources. The development activities covered the entire value chain including crystal growth-, wafering-, epitaxial-, and device/component-related topics.

The composition of members of the consortium was aiming to evaluate the complete process-line from along the typical supply chain from substrate to device. Thus the internal feedback loops as well as the external feedback-loops between project partners were the most important tools for examination and improvement.

The main development workload was located at SiCrystal. A new high quality crystal growth process for 3 inch semi-insulating SiC substrates had to be developed. Necessary feedback loops were activated with time, starting at wafer manufacturing level and extending over time to device level. This stepwise approach ensured involvement of the following processes at an appropriate point in time to verify the new developments. The final GaN-device quality feedback served as a verification of the resulting quality of the complete supply chain and thus granting the successful realization of substrate and epitaxy quality goals. The participating epi-houses were working in parallel, so that a broader coverage of technology variants and process spread due to specific differences in epi-reactor technology could be screened.

The data of s.i. SiC substrates and later epi and device process steps were reviewed at the mid of the project time and finally at the end of the project. The analysis of the data included cross-correlations of different properties as well as investigations on the distribution of all properties, including detailed analysis of individual results where appropriate. In this way, key parameters and characterization properties were identified and irrelevant parameters could be dropped. The origin for deviations from the project partners' expectations was traced and conclusions for the next wafer and epi-wafer shipment to project partners were drawn. For verification of the specification a set of "golden" wafers was identified on the basis of device performance. In this way each a specification for bare wafers as well as epitaxial wafers was established.

These specifications represent the final result and achievement of this project. The verification of the specification for the complete process line for semi-insulating 3inch SiC wafers to high power GaN HEMT components has been successfully executed. Redundancies and irrelevant properties could be removed from the specification within the framework of this project. Device performance as reported by project partner UMS also including epi and device benchmark data was used as an indicator for the judgement of specifications. A multitude of process parameters and inevitable process fluctuations were checked successfully, only being limited by capacity demand. Further fine optimizations within a productive scenario with better statistical preconditions seem appropriate. As main improvements updates for the specifications for wafer and epi-wafer geometry, epi-layer sheet resistance and epi-layer Al-content are to be mentioned.

As a final result the project accomplished to demonstrate state of the art device performance as well as verification and in some parts further optimization of process parameter specifications for the main supply chain interfaces at substrate and epi-wafer level. Main topics for a future (industrial) use of these specifications should include several economic optimisations in the implementation in terms of yield and process stability.

EuSiC has significantly reduced the dependence on critical technologies and capabilities from outside Europe for future space applications by establishing an independent, purely European sustainable chain for Gallium Nitride (GaN) based space technologies. Final target of the project was to provide 3 inch semiinsulating SiC substrates having a quality which is superior to that available from non-European sources. During this project European high quality semi insulating SiC substrates were developed by SiCrystal which are equal or better than the non-European substrates. Devices based on AlGaN/GaN epi layers with structural and electrical properties close to the corresponding data on Cree substrates were achieved