Corrosion research agenda for:
"Sustainable Power Electronics by Improved Robustness against Climate Stress" by GfKORR - Gesellschaft für Korrosionsschutz e. V., ECPE European Center for Power Electronics e. V.

Society is under the influence of the global megatrends of climate change and scarcity of resources, shifting of economic powers, urbanisation, demographic change and digitalisation. In order to successfully counter these changes and even shape them positively, power electronics has taken a key role in all fields of society. In order to meet the increased demands on the robustness and reliability of power electronic components and systems, comprehensive knowledge of their corrosion behaviour is necessary. However, corrosion mechanisms are highly complex. They depend on the materials, the environment and the respective protective measures. Accordingly, efforts must urgently be taken up in the most diverse research fields in order to create a comprehensive and secured data situation.

Due to the increased demands on power electronics, corrosion research in the field of electronics and electrical engineering will have to take an increasing role.
For example, the hydrogen economy will play a decisive role in the alternative energy concepts and the adequate storage of this energy, which is not generated at the time of consumption. Here, in the initial phase, proportions of pollutant gases that cannot yet be estimated will also accompany the green hydrogen, favour corrosion reactions and thus in turn severely limit the usability or service life of the components used. Exactly here are also long and especially reliable service lives necessary in order to create benefit in terms of application technology.
In the field of power electronics, Europe has a very strong position in industry and research. In order to maintain this position, it is important to make optimal electrical use of the power electronics components (especially semiconductor components such as Si-IGBTs or SiC-MOSFETs). However, this increases the operating loads and electrical sensitivity of the modules. This should be compensated by improved corrosion protection and thus minimised leakage currents.
The upcoming modernisation of the railway, from the track to the smart goods wagon, also requires very good corrosion protection due to the often-harsh environmental conditions in order to exploit the economic benefits through the best availability of the systems. Intelligent housing solutions in particular will play a key role here in the future.
In order to achieve the reliable implementation of the mentioned social goals as well as increased sustainability (energy saving, resource conservation ...) by increasing service life and efficiency, corrosion research must address the following fields:

- Aluminium and copper corrosion at chip level, i.e. the influence of moisture and the smallest impurities on power semiconductors.
- Corrosion protection of the so-called aluminium guard rings by glass or polymer passivations in order to keep the reverse voltages of power semiconductors stable
- Prediction of corrosion processes, especially from the so-called anodic migration phenomenon (AMP) and electrochemical migration in complex environments such as wind power plants, railway systems or in electromobility
- Development and optimisation of high-voltage and high-temperature resistant corrosion protection systems

This results particularly in the following research topics:

- Expansion of knowledge on the role of pergulating networks in the anodic migration phenomenon in potting or epoxy molding compounds
- Development of alternative high-voltage protection systems such as parylene, ALD and similar ones for so-called sandwich modules, which enable smaller and more universally applicable power electronics
- AMP-resistant solder resist and protective coating systems for moisture-robust and ageing-resistant power electronics