Comments on EU Chips Act

Regarding 'green transition':

As a solar cell (photovoltaics) researcher, I want to highlight a few European initiatives that aim to strengthen European PV manufacturing. The background is, that while EU is still leading most research efforts in PV globally, almost all industrial production of solar cells and panels is now in Asia (mainly China). This is not just a challenge from an economic perspective (growth, manufacturing jobs), but certainly also from an energy supply security perspective.

- A distributed PV pilot line (https://isc-konstanz.de/en/pv-pilot-final-report/) has been established in Germany, combining facilities at the research institutions Fraunhofer, ISC Konstanz, ISFH and Helmholtz-Zentrum Berlin. This pilot line is targeting a production volume of minimum 300 MW, to make it industrially meaningful. By combining existing academic pilot lines, the idea is to de-risk the realization of large production facilities, while utilizing valuable expertise already present at the research institutions. This could be a model for future expansion of European activities, also beyond the field of photovoltaics.
- A new "EU Gigafactory", run by the company 3Sun (https://www.3sun.com/), is being established and already running at large throughput in Italy. With a planned capacity of 3 GW and current throughput of 800.000 solar cells per day, they are currently the only European manufacturer with volumes comparable to the large Chinese PV industry. Technically, the company focuses on silicon heterojunction cells, that also hold the current world record efficiency. Aligned with general industry trends, they also target tandem devices in 2028, probably adding perovskite top cells on top of the current silicon bottom cells. In addition, and as a means of diversifying, the plant already uses machine learning to optimize and evaluate production yield and cell efficiency. This could be a new strategy for other European companies in tight competition with e.g. Asian counterparts. This idea also utilizes the European stronghold in machine learning and similar computing techniques (deep learning, spiking neural networks).

General comments, from the perspective of Aarhus University:

Establishment of the Danish Chips Competence Centre (DKCCC), which provides Danish small and medium-sized enterprises (SMEs) with access to expertise and facilities for chip design and production. While headquartered at DTU, we are happy to be involved at AU and ECE, also given our research efforts (and teaching) within chip design and related topics such as cleanroom fabrication of MEMS/sensor devices, solar cells etc.

At ECE in the "Photovoltaic Devices" group, we have several ongoing research projects that rely on cleanroom fabrication of semiconductor devices, both in collaboration with other Danish partners like DTU, but also Danish (NKT Photonics, Atlant3D, Elplatek) and European (Sunplugged, CSEM, Meyer Burger) companies.

We plan on strengthening such collaborations via Danish and EU funding schemes. While some of these companies are mainly focused on solar cells, others will be more broadly interested in the fields covered by the EU chips act: Two examples are Atlant3D, a spin-off company from DTU, having developed a tool that prints atomic thin layers locally; ideal for the next-generation chip manufacturing and prototyping. And NKT Photonics, that develop advanced laser systems for both quantum, space and life science (in addition to our current collaboration on photovoltaics). With a continued – and maybe even strengthened – effort in the EU Chips Act, we foresee excellent opportunities for new research and industrial R&D projects with such companies.

In general, a few notes on how to strengthen/diversify in the future – based on my experience from the solar cell world:

- "Smart manufacturing"; machine learning (we are experts at ECE) e.g. for optimization of manufacturing lines and identification of new materials for active layers in devices, development of new tools (such as the ones from our partners at Atlant3D and NKT Photonics), increased use of robotics (Denmark has a stronghold).
- Focus on sustainable materials. An example from PV is replacing Ag with Cu. The entire industry agrees that this must happen soon; at least to some degree, since the expected increase in installed PV capacity will consume the entire global silver reserve (source: *B. Hallam, M. Kim, Y. Zhang, L. Wang, A. Lennon, P. Verlinden, P.P. Altermatt and P.R. Dias, "The silver learning curve for photovoltaics and projected silver demand for net-zero emissions by 2050", in Progress in Photovoltaics: Research and Applications, vol. 31, i. 6, pp. 598-606, 2023.*) But new technology is needed to make it reality. European materials science – and related industry – is very strong, so we have a chance to succeed. With solar cells as an example, we do not need to compete on cost (incl. labour) and even efficiency, if we manage to use more abundant, cheap and thus sustainable materials. A similar challenge is found for indium, present in ITO, which is used in many fields beyond PV (electronics, displays). Again, finding sustainable alternatives (that work!), gives EU a pathway to success that does not solely rely on cost-competitiveness.