

# T. Nakamura Lab.

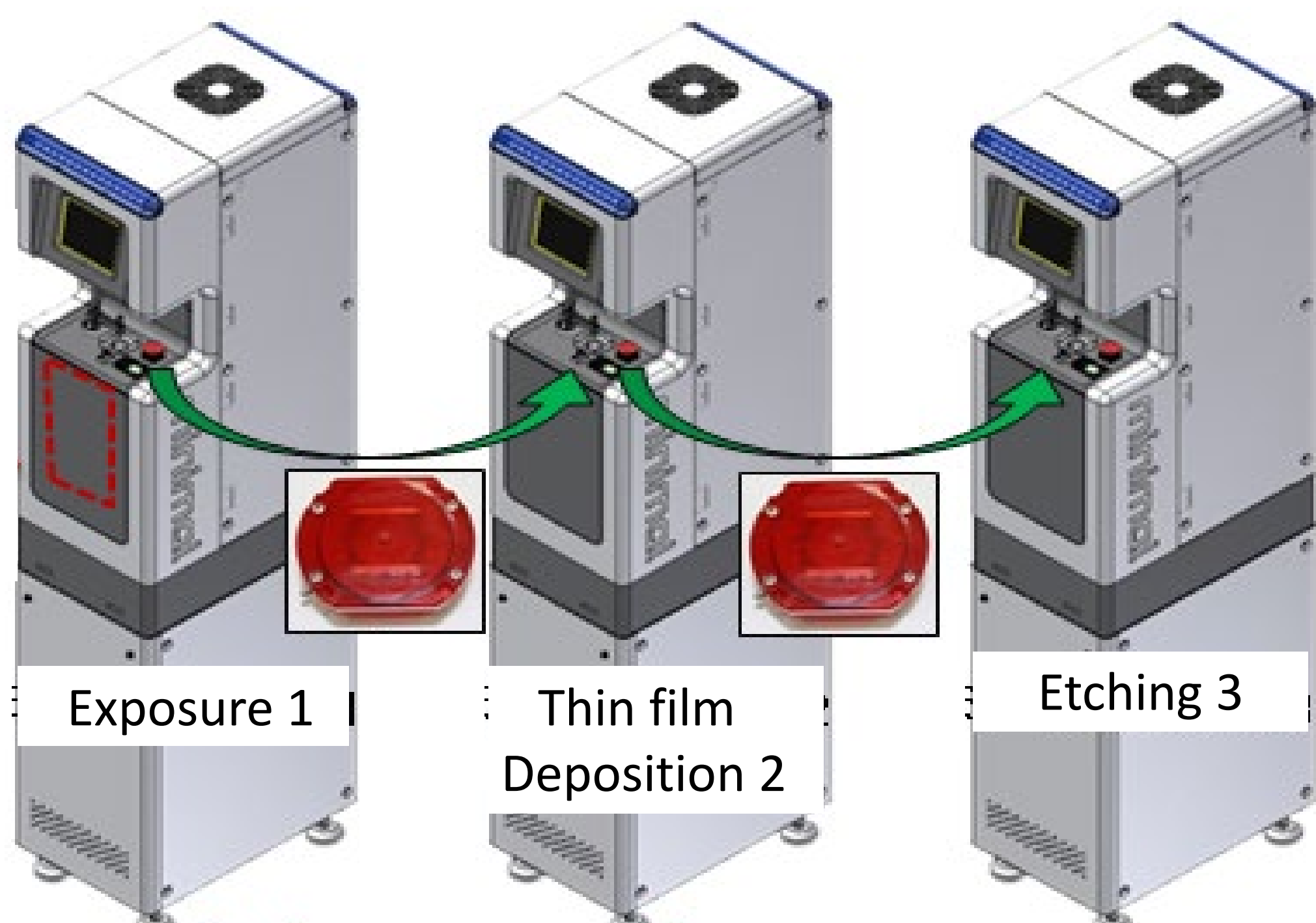


[Innovative process technology to accelerate original device development and production]

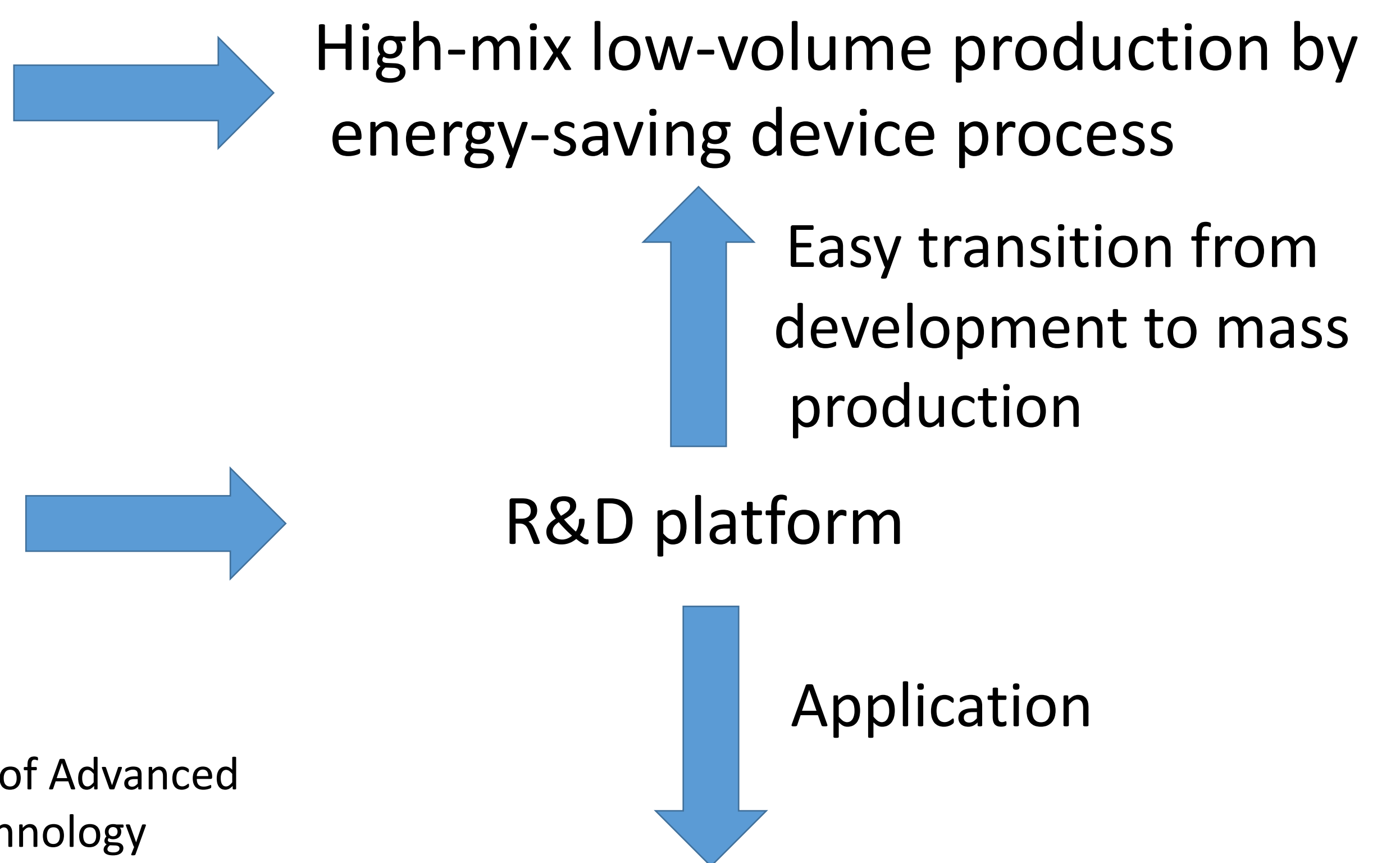
Energy saving device process

Department of Materials and Environmental Science

In order to develop and commercialize high-mix low-volume semiconductor devices (domestic market size: 20 billion USD @ 2018), especially IoT devices, there are many issues such as acceleration of development period, smoothly shift from development to mass production, reduction of mass production equipment investment and just-in-time production. The 1/2" wafer/single wafer processing scheme promoted by the National Institute of Advanced Industrial Science and Technology is expected to be one solution to these problems. However, there are new problems to be solved, such as restrictions on miniaturization and automation, and the need for high-throughput production. In order to solve these problems, especially for thin film growth equipment, we develop chamber materials, heating methods and active species excitation methods to realize innovative process technologies. When a series of process technologies can be established, it can be used as a device process platform for research at universities and research institutes. By using this platform, we will promote to research and develop wide-gap semiconductors (GaN, Ga<sub>2</sub>O<sub>3</sub>, etc.), which are expected to serve as energy-saving devices.



Source: National Institute of Advanced Industrial Science and Technology

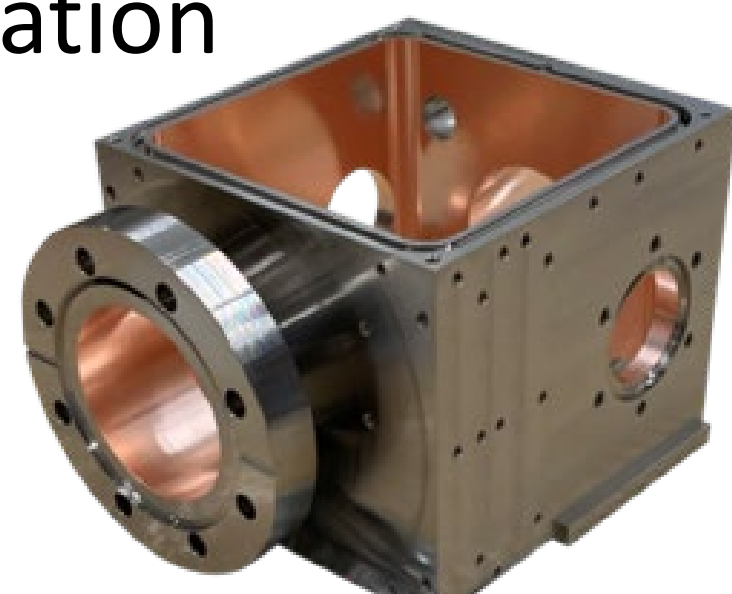


## Equipment/process/production technology development

Development of compact and automated production system that can be housed in standard housing of W294xD450xH1440mm ← Chamber material, heating method, active species excitation method, elementary process consideration



Ultra-small and high-throughput sputter

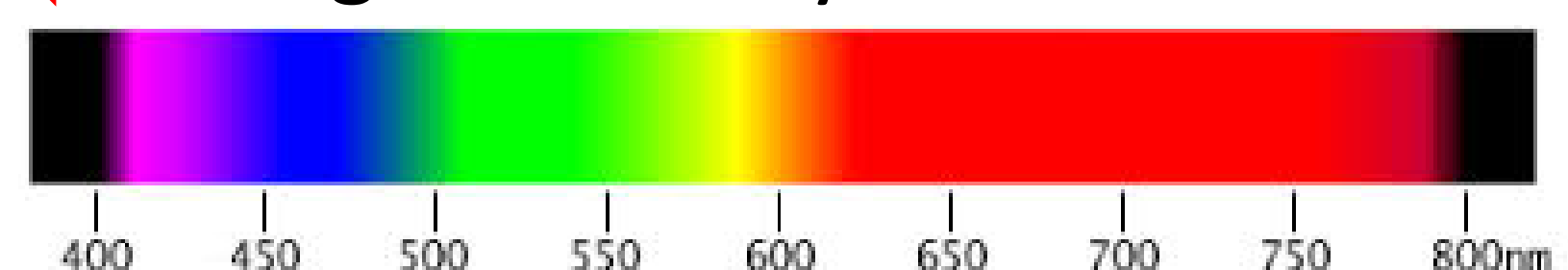


0.2%Be-Cu small vacuum vessel

## Energy saving device development

GaN-based light emitting device

← High efficiency and low cost

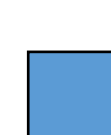
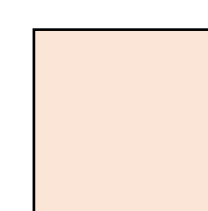
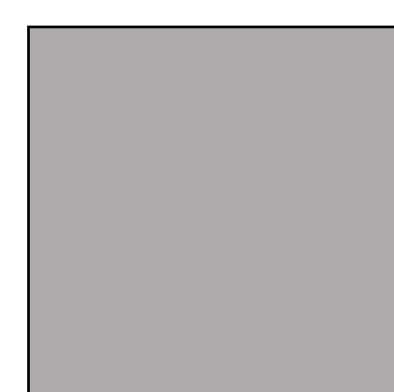


Ga<sub>2</sub>O<sub>3</sub>-based power devices

Si

SiC

Ga<sub>2</sub>O<sub>3</sub>



Chip size reduction per unit current + cheap substrate ⇒ Energy saving device process