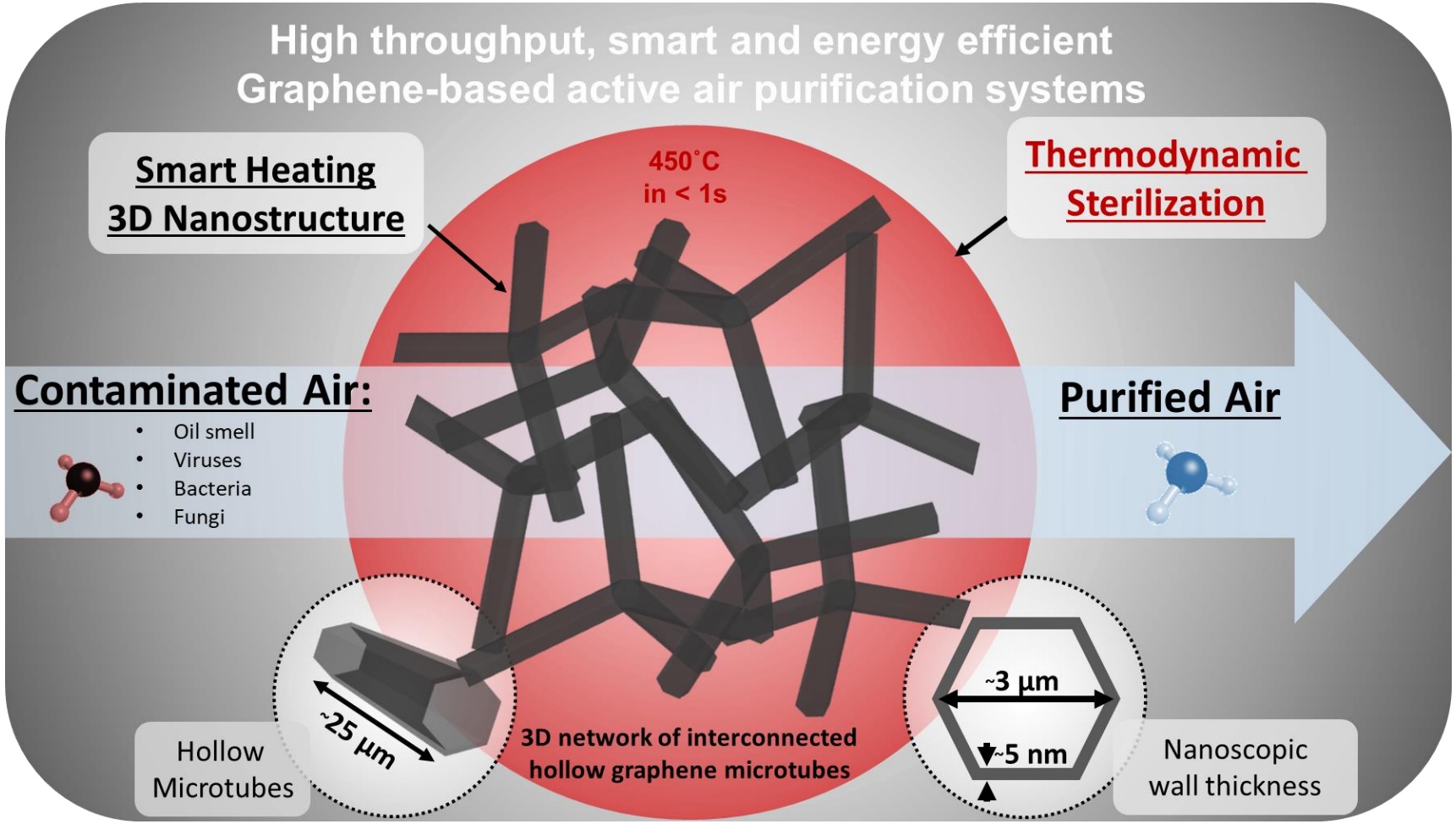

High throughput, smart and energy efficient
Graphene-based active air purification systems
Smart Heating
3D Nanostructure
450˚C
in < 1s
Thermodynamic
Sterilization
Contaminated Air:
Oil smell
Viruses
Bacteria
Fungi
Purified Air
~25 µm
Hollow
Microtubes
3D network of interconnected
hollow graphene microtubes
~3 µm
~5 nm
Nanoscopic
wall thickness

High throughput, smart and energy efficient Graphene-based active air purification systems

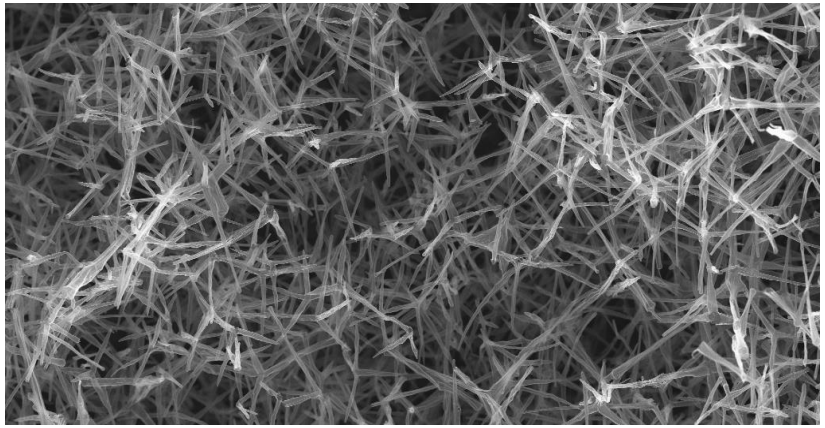
Ultra light weight carbon-nanomaterial based macroscopic framework structures with densities down to **0.18 mg/cm³** (porosities > 99.99%)

The structures consist of randomly interconnected **hollow microtubes** (~20 µm) with nanoscopic (well below **50 nm**) wall thickness

High electrical conductivities of up to **100 S/m**

Negligible Poisson ratio based on the unique microstructure

Highly vibration resistant due to unique microstructure of hollow carbon microtubes



- High porosity (>99.99%) and open porous structure

→ **high air change rates**

- Resistive heating (up to 400° C)

→ **Thermodynamic sterilization AND decomposition of pathogens**

- Low power consumption

→ **energy efficient active filter system**

- Thermal decomposition of pathogens

→ **no filter replacement needed → long life-time**

→ **no UV lamps are needed**

- Safe Air purification

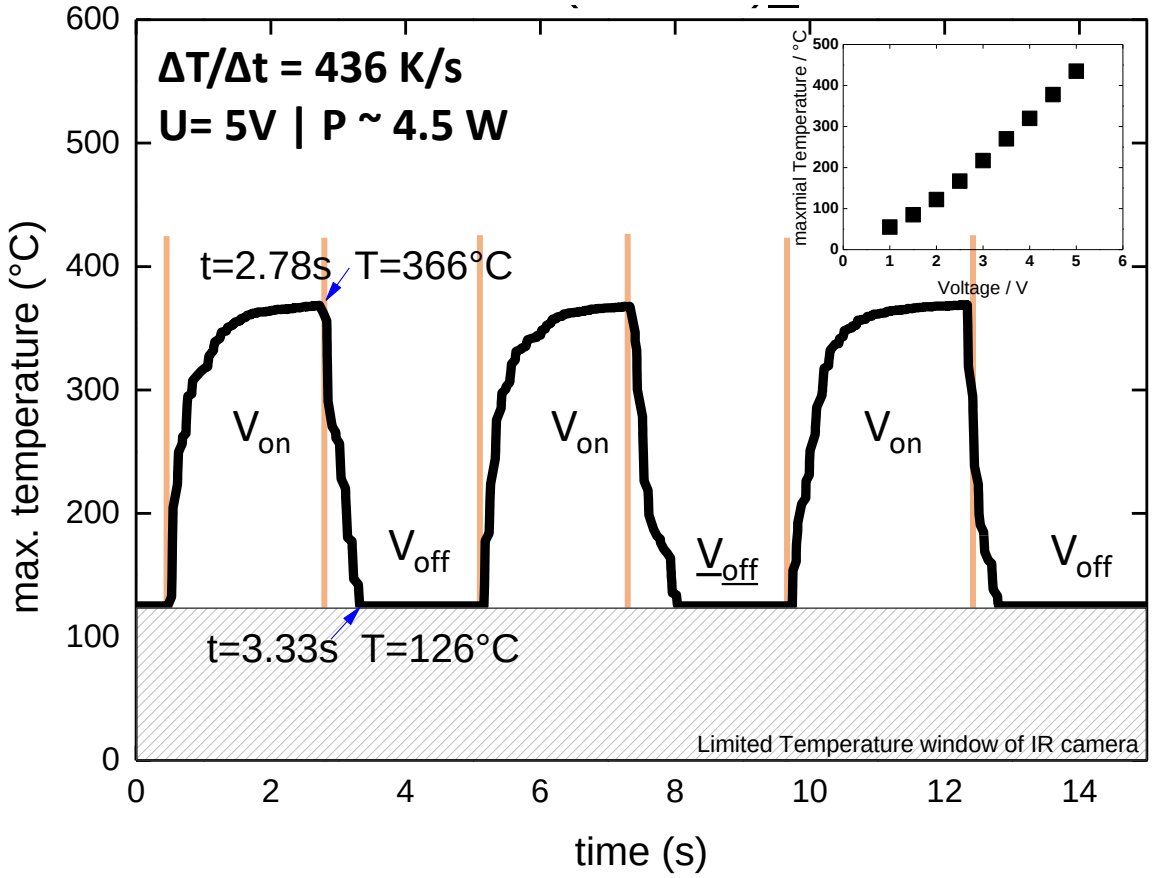
→ **no Ozone or hazardous emissions**

- Smart filter

→ **change in conductivity can be used to measure operational conditions, e.g. pathogen coverage, air flow, etc.**

- Graphene-based Aeromaterials can be **heated up to 400 ° C** by resistive heating
  - Heating of complete cm³ volumes
  - Heating and cooling rates of >400 K/s
  - Based on
    - Negligible heat capacity
    - Large free volume (>99.99%)
    - High surface area

Enables thermodynamic sterilization AND decomposition of pathogens



Keeping dust from reaching the internal workings of any engine is critical. Whether a business operates an Airbus or a regional aircraft fleet, one thing they all have in common is recurring air filter maintenance. The *AEROGrAFT* Spearhead Project, announced by the Graphene Flagship, is set to produce heatable aero-graphene foams, to reduce the cleaning time of aero-material filters in the aerospace industry, saving businesses huge sums of maintenance costs and downtime.

AEROGrAFT Spearhead Project is on a mission to develop prototype self-cleaning air filters that use aero-graphene foam. Developed with graphene's homogenous heat distribution properties in mind, the graphene-enabled foam will ensure even heat throughout the air filter, to elicit a consistent cleaning across all air filter surfaces. What's more, the self-cleaning air filters can use the same graphene foam repeatedly, for recurrent cleaning cycles, without losing stability.

The foam's volume manufacturability will be improved over the project duration, with the end goal of producing foams to volumes of over 200cm^3. Halfway through the Spearhead, the project leaders expect the aero-foam to remain stable for over 50 cycles. Three years into the project, they expect the aero-foam to remain stable for over 100 cycles, meaning aircraft operators can use the self-cleaning properties of the air filter over longer periods of time. Not only will the self-cleaning filter mean less servicing, but also quicker cleaning. The team believes it will have developed a prototype filter that will take less than 30 minutes to clean within 18-months. By the end of the project in 2023, this will be below the ten-minute mark. The team will test the prototype aero-material filter systems against aircraft certification requirements, to ensure compliance and eventual certification. Beyond the Spearhead Project, the self-cleaning air filters, once certified, will be ready for the next stages of commercial application, to save the aerospace sector the associated maintenance costs.

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