

Title: Influencing parameters of nanoparticles formation from diesel exhaust

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### Summary

A modern light duty diesel vehicle, a conventional gasoline vehicle and an indirect injected light duty diesel engine were investigated. The sample was taken by a porous tube dilution unit to minimise sampling losses. The results were:

Light duty diesel vehicle:

- load had an enormous effect on nucleation
- stabilisation of nucleation took at least 10 min.
- strong humidity dependence
- humidity could initiate nucleation

Light duty gasoline vehicle

- nucleation only appeared at full load with  $\lambda < 1$
- stabilisation of nucleation took at least 10 min.
- no humidity dependence

Light duty diesel engine, IDI

- NO nucleation by varying load and humidity

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# **Influencing parameters of nanoparticles formation from diesel exhaust**

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# Objectives

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- Investigation of the sampling parameters for nucleation:
  - define the region of nucleation
  - define region where nucleation can be influenced
  - reproduce nucleation

# Investigated engine/vehicles

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- Light duty diesel vehicle

- ∞ displacement: 1.9 l, diesel, DI
- ∞ max. power: 74 kW (4000 rpm)
- ∞ max. torque: 240 Nm (1800 rpm)
- ∞ fuel sulphur: 320 ppm

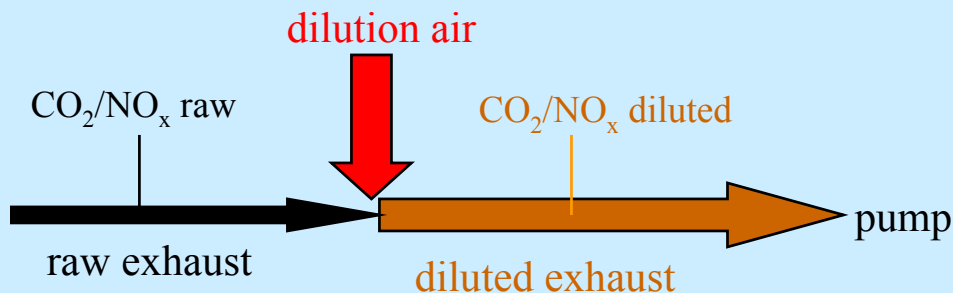
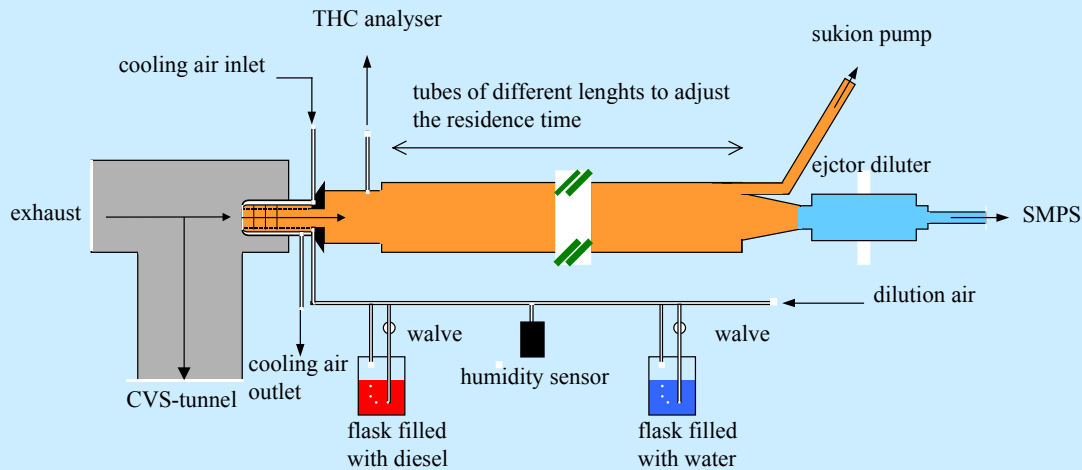
- Light duty gasoline vehicle

- ∞ displacement: 1.2 l, gasoline, reg.
- ∞ max. power: 44 kW (5250 rpm)
- ∞ max. torque: 93 Nm (2500 rpm)
- ∞ fuel sulphur: 40 ppm

- Light duty diesel engine

- ∞ displacement: 1.6 l, diesel, IDI
- ∞ max. power: 51 kW (4500 rpm)
- ∞ max. torque: 133 Nm (2600 rpm)
- ∞ fuel-sulphur: 350 ppm

# Porous tube dilution unit



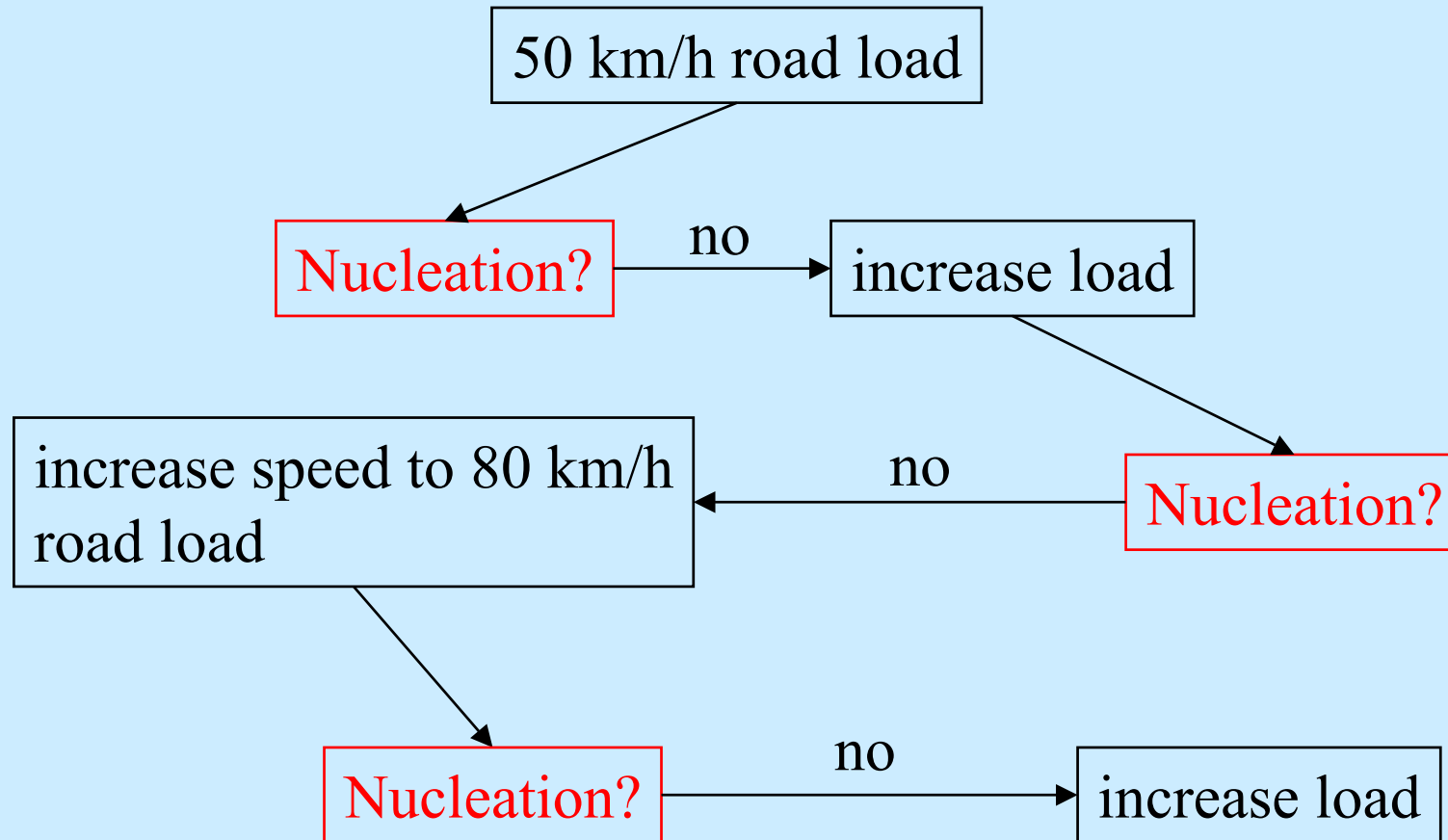
- Advantages

- ∞ minimise sampling losses
- ∞ variable dilution ratio
- ∞ control of dilution air temperature
- ∞ moisten of dilution air

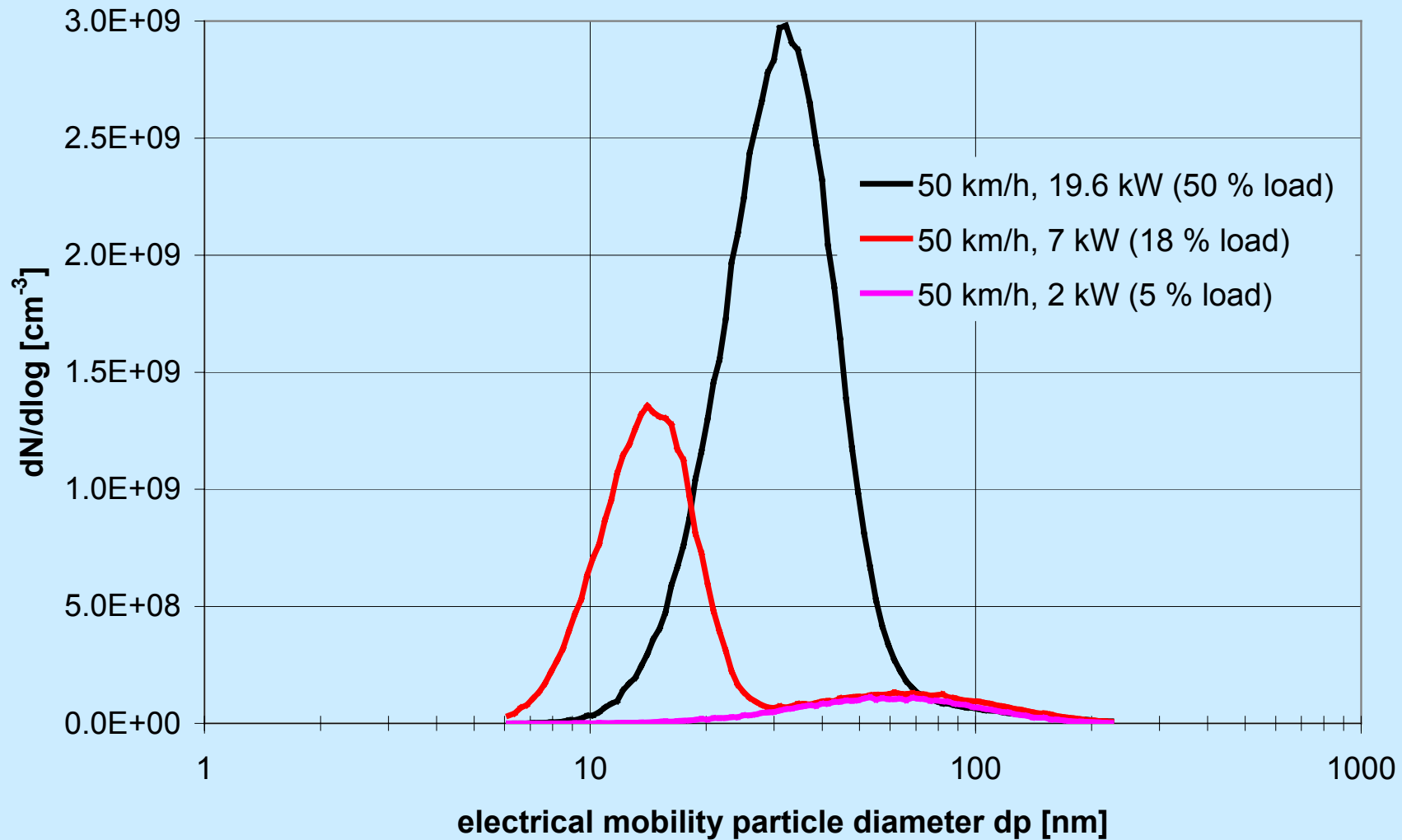
- Disadvantages

- ∞ difficult flow control
- ∞ constant CO<sub>2</sub> or NO<sub>x</sub> measurement of raw and diluted gas to control dilution ratio

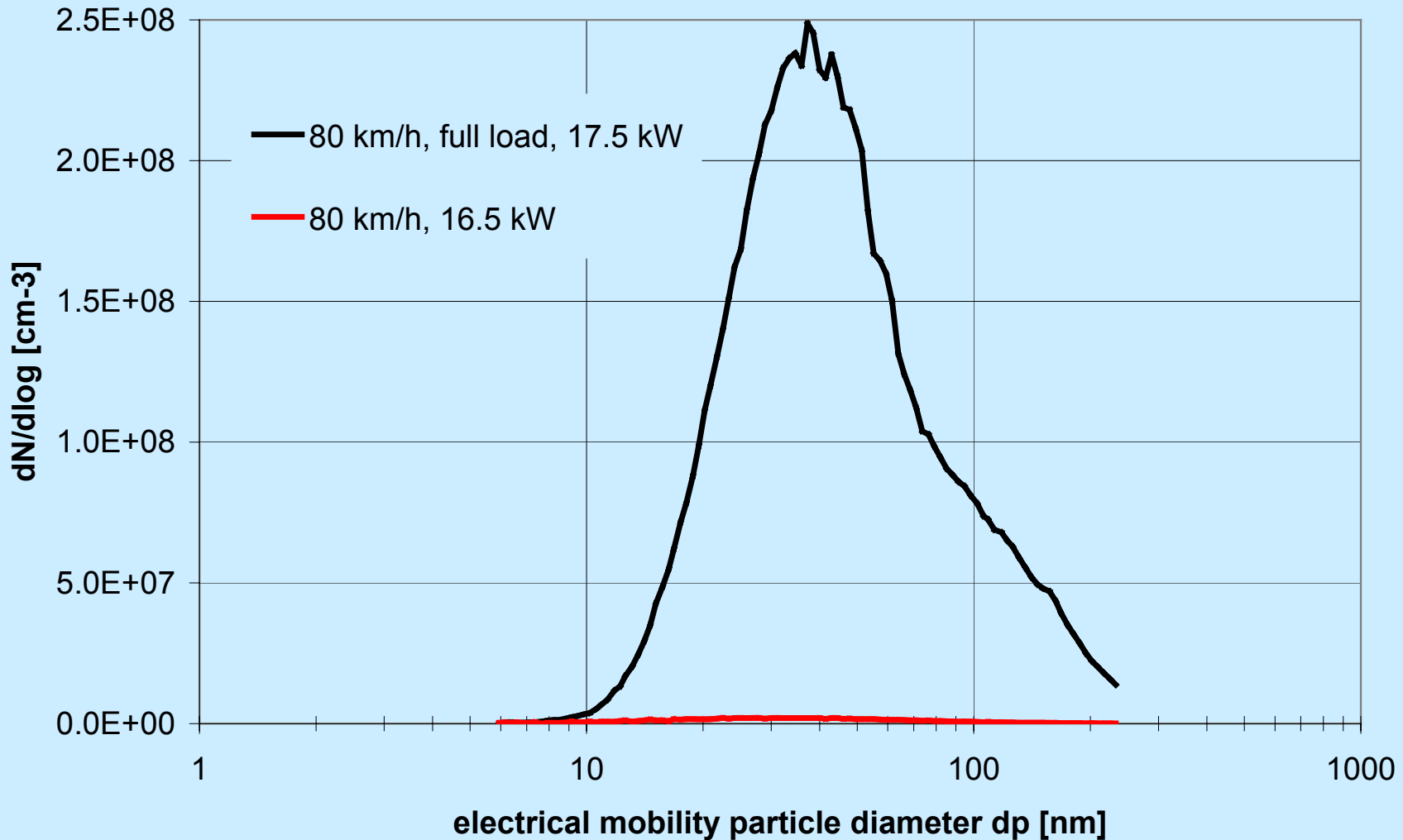
# How to find nucleation?



# Load effect: diesel vehicle

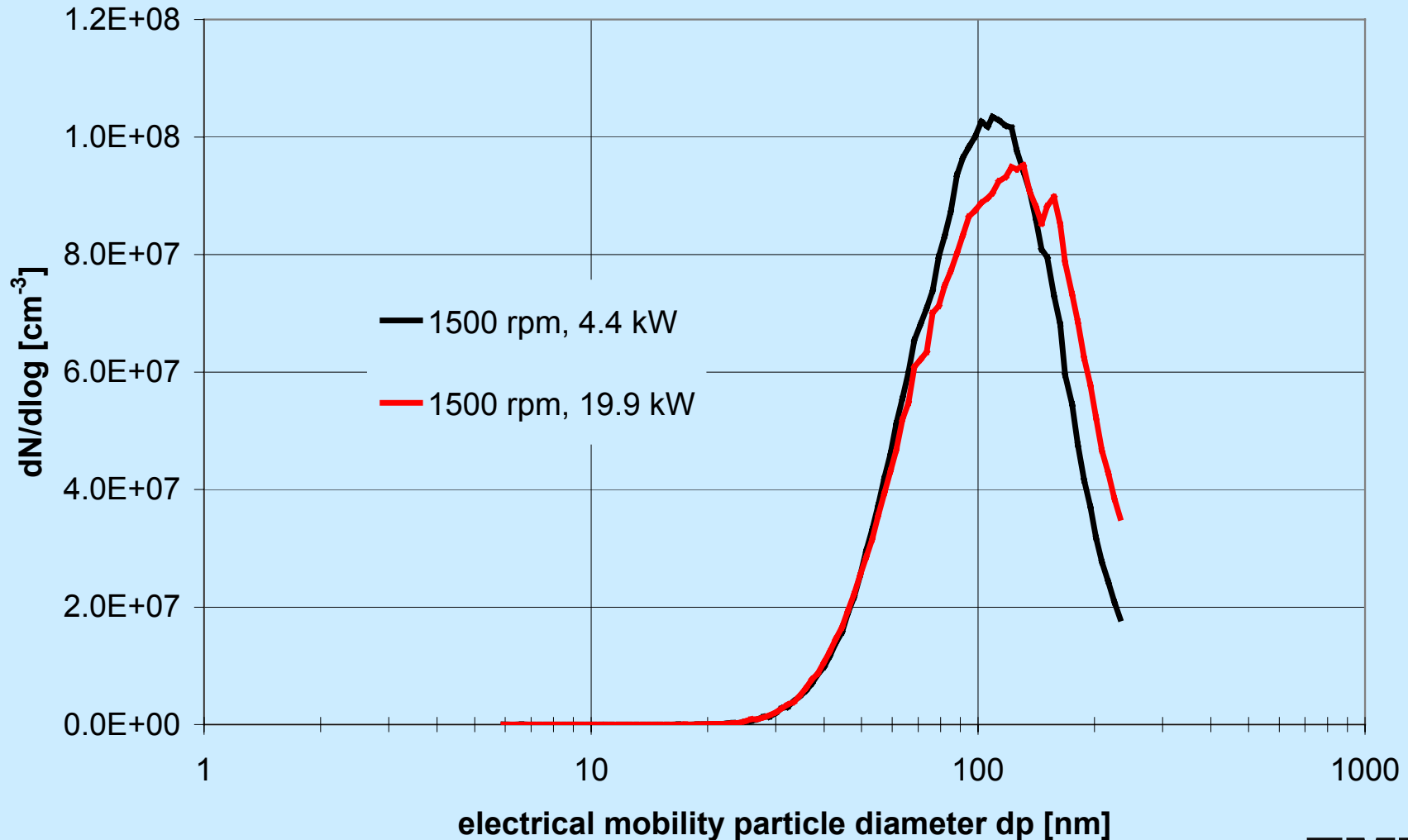


# Load effect: gasoline vehicle

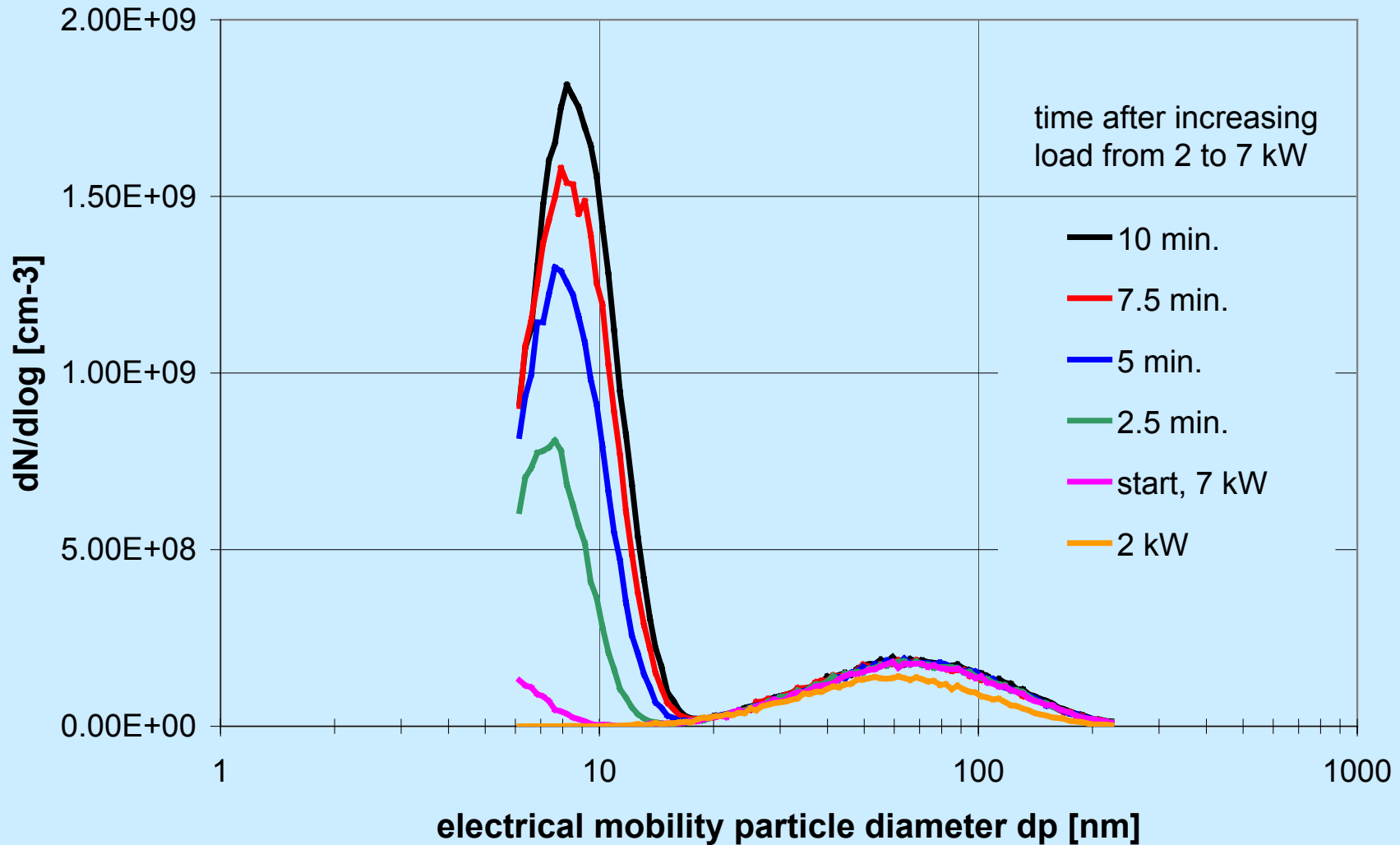




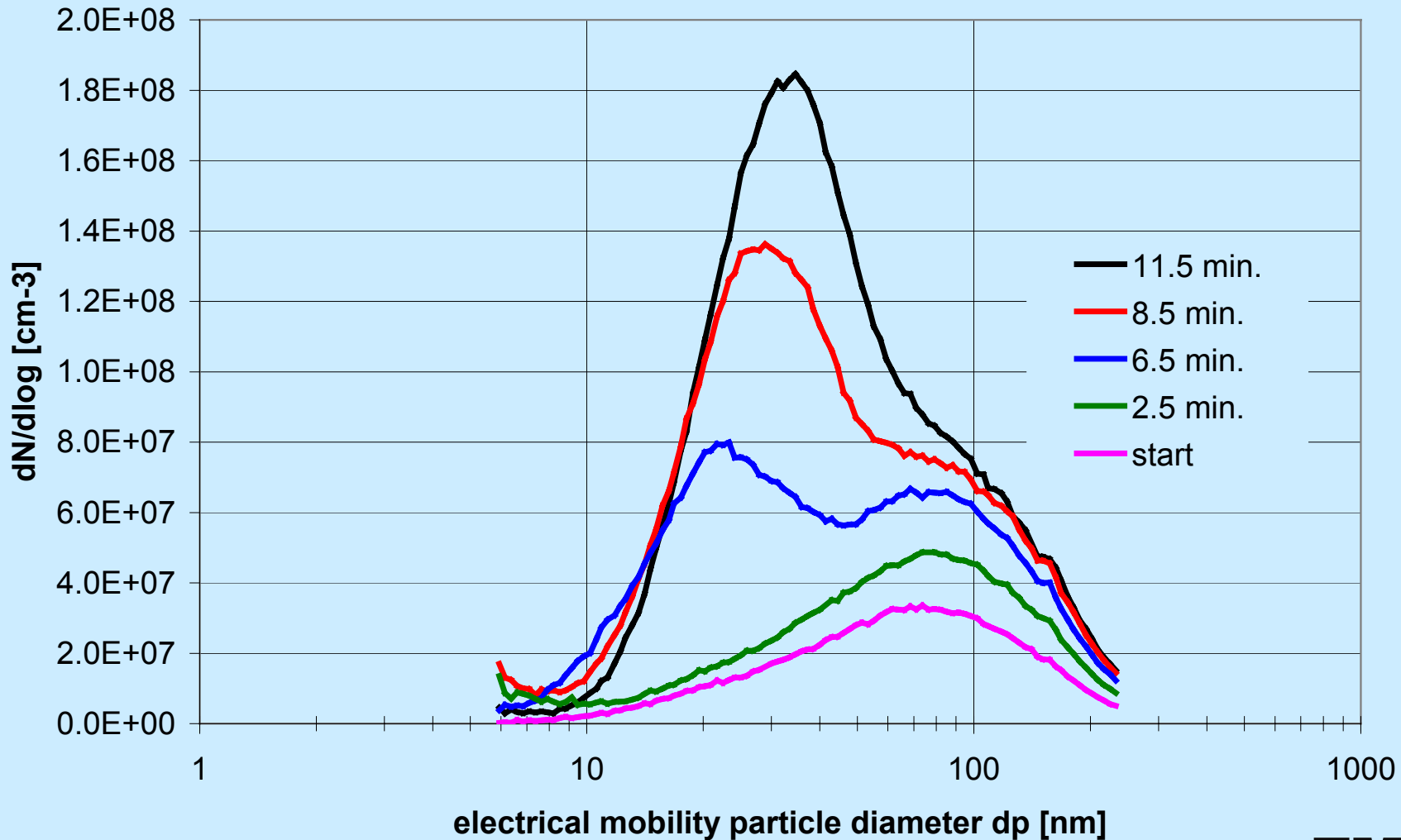
# Load effect: diesel engine



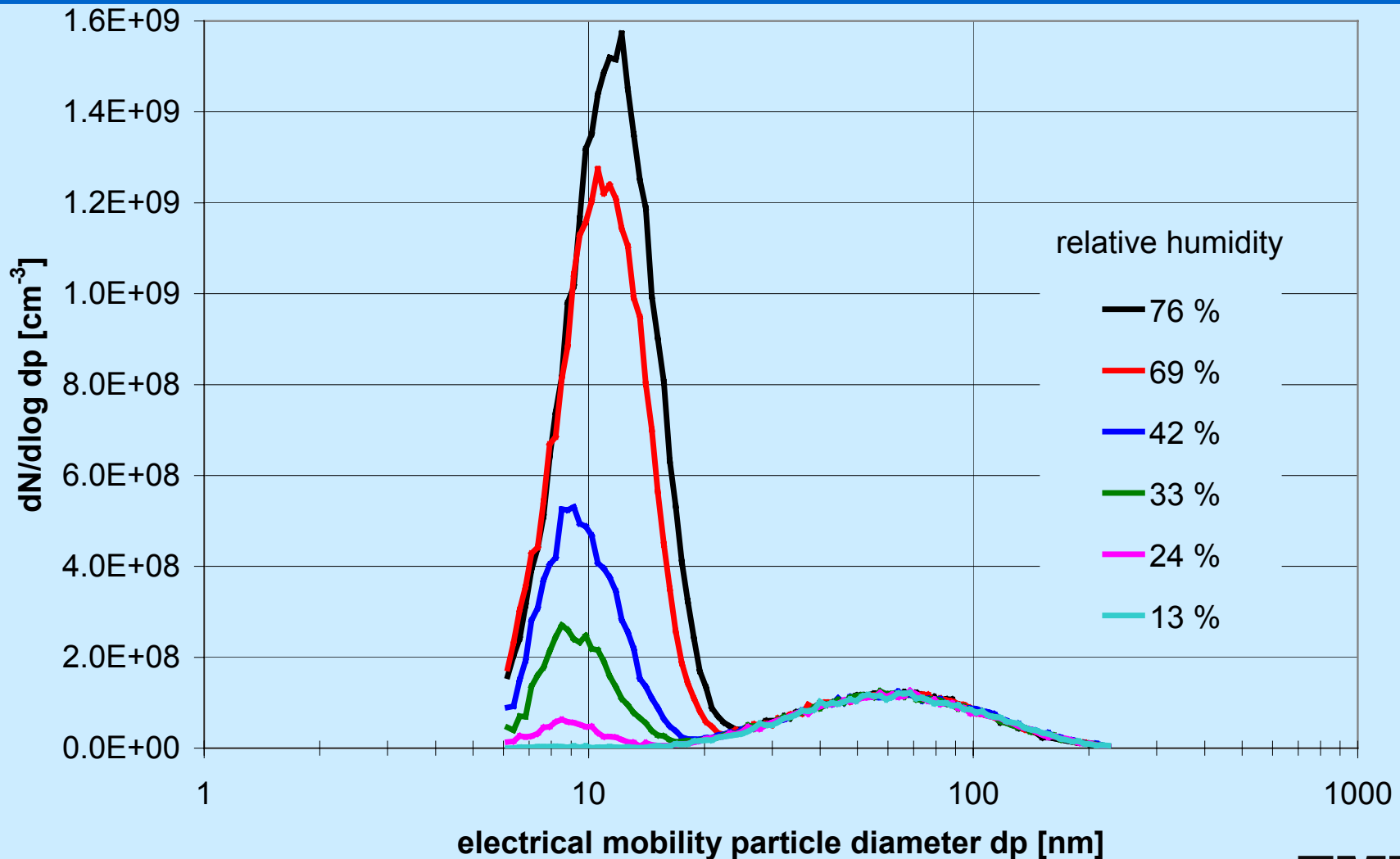
# Stabilisation of nucleation: diesel vehicle



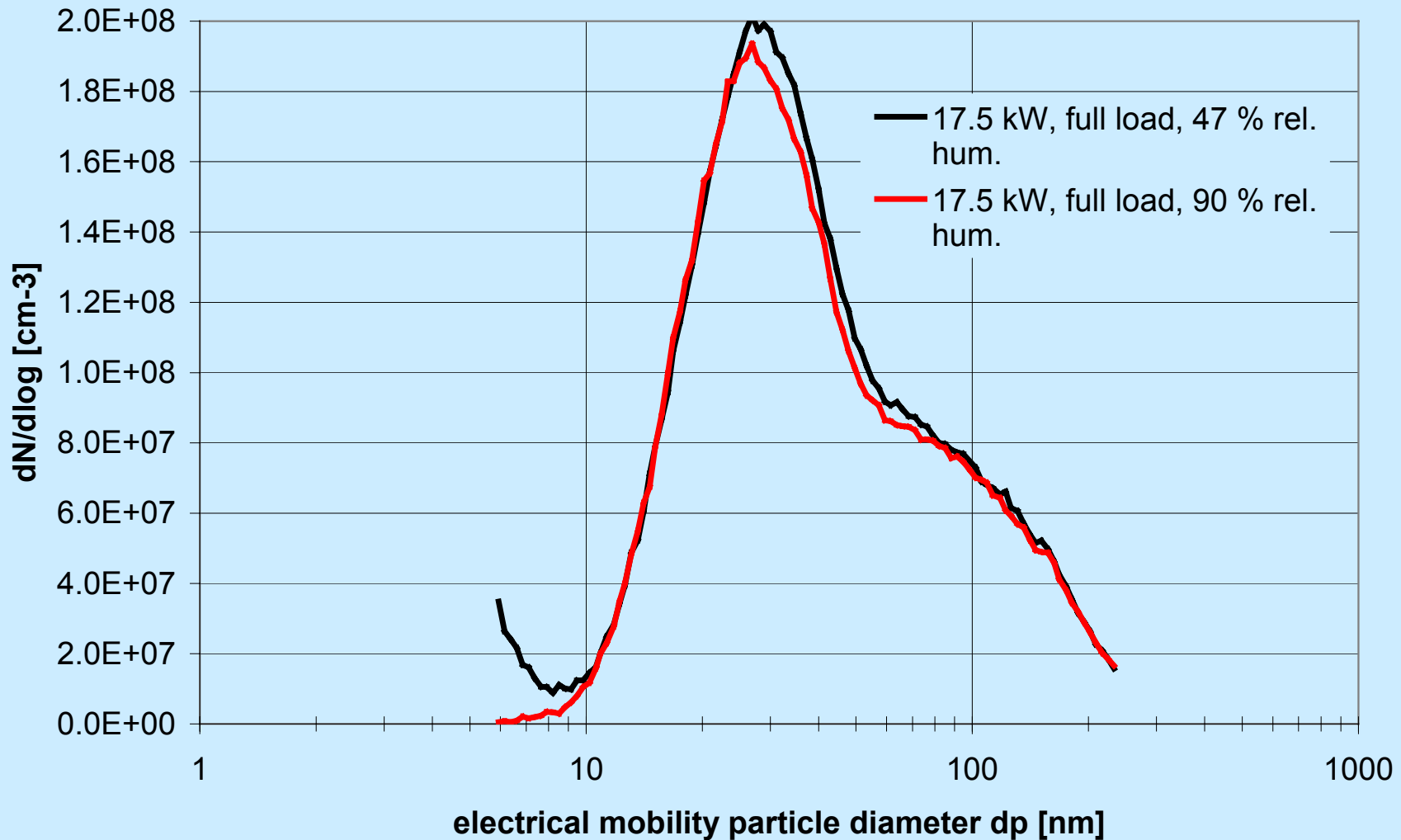
# Stabilisation of nucleation: gasoline vehicle



# Humidity: diesel vehicle



# Humidity: gasoline vehicle



# Conclusions

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- Light duty diesel vehicle
  - load had an enormous effect on nucleation
  - stabilisation of nucleation took at least 10 min.
  - strong humidity dependence
  - humidity could initiate nucleation
- Light duty gasoline vehicle
  - nucleation only appeared at full load with  $\lambda < 1$
  - stabilisation of nucleation took at least 10 min.
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- Light duty diesel engine, IDI
  - NO nucleation by varying load and humidity

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# Thank you for your attention

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