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Electron Microscopy for Morphological Analysis of Black Carbon Accumulated in Glaciers

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Since the mid-20th century the decrease in anthropogenic emission of Black Carbon in Europe and North America has been recorded as a decreased Black Carbon accumulation in Greenland. However, the present-day concentrations of Black Carbon in Greenland are higher compared to the Black Carbon concentrations from the pre-industrial time, and the Black Carbon concertation in the Arctic.

Accumulation of Black Carbon in the glaciers correlates with a decrease in the surface albedo and therefore Black Carbon is thought to be one of the causes that lead to the melting of the glaciers. The morphology of Black Carbon depends on its origin, the various processes during transportation and the incorporation process into snow.

In the present study we evaluate the use of electron microscopy for morphological analysis of Black Carbon. We use both scanning electron microscopy (SEM) and transmission electron microscopy (TEM) for the analysis of Black Carbon in snow collected from Greenland and Alaska. We show that there is a morphological preference for the Black Carbon depending on the snow origin: Black Carbon found in snow from Greenland has fewer monomers arranged in a lacey, chain like, shape, while Black Carbon found in snow from Alaska has a large number of monomers arranged in a compact, onion like, shape.

These preliminary results show that electron microscopy can be used for morphological analysis of Black Carbon accumulated in show and glaciers, and that the Black Carbon particles present morphological differences depending on their origin.