

Group	Major elements	Morphology/ beam stability	Source/particle explanation
Soot	C	Chain-like or more compact agglomerates of primary particles	Combustion, black carbon
C-rich particles	C	No soot morphology	Organic aerosol, biomass burning**, biological**
Complex secondary particles	No X-ray spectra or S peak	Most particles evaporating, some relatively stable	Sulfur-rich secondary organic aerosol; might also contain a substantial fraction of nitrates and other organics
Aged – sea salt	Na, S (sometimes small amount of Cl and Mg)	Relatively stable	Marine aerosol, sea spray, might contain organics
Mixed – sea salt	Na, S (sometimes small amount of Cl and Mg) + mineral composition		Marine aerosol mixed with mineral particles. Might contain organics.
Ca-rich particles	Ca, C, O		Mineral particles, calcium carbonates, e.g. calcite
Ca sulfate	Ca, S, O		Mineral particles, e.g. gypsum and anhydrite
Silica	Si, O		Mineral particles, e.g. quartz
Aluminosilicate	Al, Si, O		Mineral particles, e.g. kaolinite
Fe aluminosilicate	Al, Si, Fe, O		Mineral particles, e.g. almandine
Other aluminosilicates	Variable amounts of Na, K, Ca, Si, Al, O, Ti, and Fe		Mineral particles, e.g. feldspars, illite, and smectite (montmorillonite)
Metal/metal oxides	Fe, O or Ti, O or Fe, Cr, Mn	Fly ash was detected as spherical particles	Mineral particles like hematite, magnetite, and rutile, or steel particles (alloys)
Pb-rich particles	Pb, or Pb, Cl	Single particle or inclusions within particle	Helicopters and small aircrafts, previously reported at Jungfraujoch
Other	Particles which do not meet the classification criteria above		
Alumina*	Al, O		Artefact, Ice-CVI
Ni-rich particles*	Ni		Artefact, Ice-CVI
Cu-rich particles*	Cu		Artefact, particle substrate
Pure salt*	Na, Cl		Artefact, hypothesized from secondary ice processes, e.g. crystal break-up, marine origin**