DEKATI

Excellence in Particle Measurements

Dekati®
Carbon Capture & Storage (CCS) Aerosol Measurement Solutions

Complete Setups for CCS Process Optimization & Monitoring

Advanced Instrumentation for CCS Technology Development and Feasibility Studies

CO_2 Purity and Quality Control for Storage and Transport

Dekati®
Aerosol Measurement Solutions for CCS Process Control and Innovation

Carbon Capture and Storage (CCS)

Carbon capture technologies are being implemented in a wide range of sectors where process-related CO_2 emissions are unavoidable. In power generation, carbon capture units are integrated with existing boilers and turbines to reduce emissions from coal, gas, and biomass plants. In cement and lime production, carbon capture addresses the CO_2 released from calcination, which cannot be eliminated through fuel switching. Iron and steel plants apply carbon capture to blast furnace gases, while refineries and chemical industries target high-purity CO_2 streams and flue gases from process heaters.

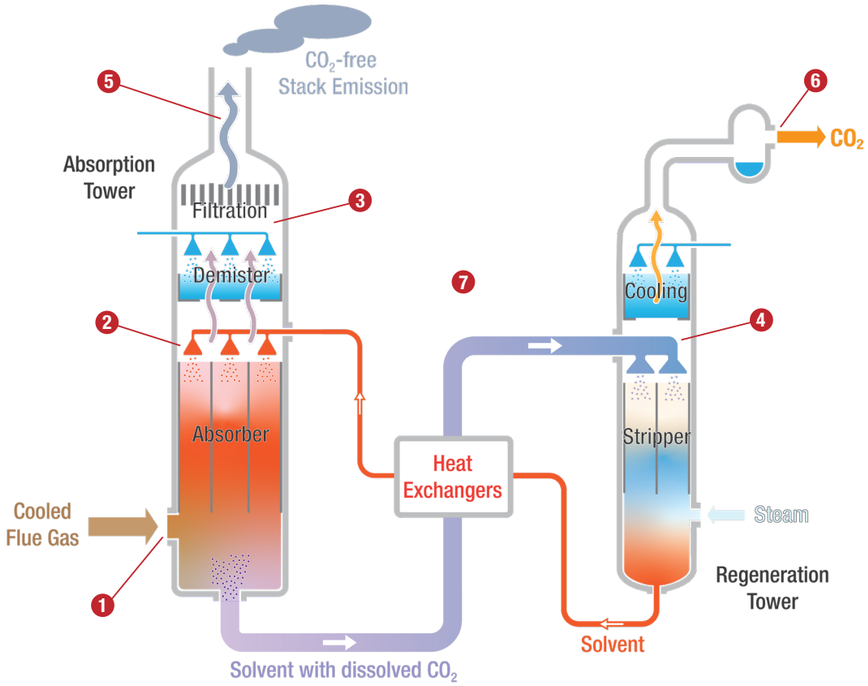
Looking ahead, CCS will also be essential for low-carbon hydrogen production for making sustainable fuels for aviation and shipping, and for achieving negative emissions when combined with bioenergy (BECCS). Across these industries, ongoing R&D focuses on solvent and sorbent optimization, aerosol control, integration with heat recovery, and scale-up strategies to lower costs and improve reliability.

The importance of aerosol measurements in CCS

Aerosol characterization is a critical aspect of CCS, both for understanding existing flue gas conditions and for ensuring reliable plant performance. Before any capture process can be applied, it is necessary to measure the aerosol concentration and especially the particle size distribution in the flue gas. These properties strongly influence capture efficiency and the design of downstream equipment, regardless of whether absorption, adsorption, or membrane technologies are used.

As flue gas is cooled during the capture process, new aerosols may form through condensation of acids such as sulfuric acid. These acid aerosols can corrode infrastructure and reduce overall process efficiency. Monitoring their formation helps operators take preventative measures and informs material choices for plant construction.

Aerosol behavior also plays a role in advanced CCS technologies. In adsorption-based systems, fine particles from sorbent materials may be released into the gas stream, affecting performance. In membrane systems, aerosol-linked fouling and chemical degradation can shorten membrane lifetime and reduce separation efficiency. Proper aerosol characterization during process development is therefore key to evaluating the technical and economic feasibility of CCS in different industries. Finally, after CO_2 extraction, gas purity is a decisive factor for both storage and reuse. Trace aerosols and acid components can compromise CO_2 quality and increase the risk of corrosion, particularly under the high pressures required for transport. Because the acid dew point rises with pressure, even small amounts of contaminants can accelerate damage. Comprehensive aerosol monitoring at this stage ensures that the captured CO_2 meets purity requirements and can be safely stored or utilized.

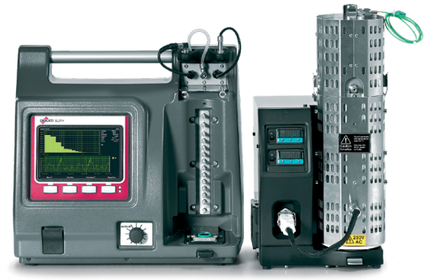


Simplified diagram of a typical CCS process, showing the main process stages that may benefit from aerosol measurements

Dekati®
Real-Time Aerosol Measurements

Dekati® High-Temperature HR-ELPI®+

The Dekati® HR-ELPI®+ system simplifies aerosol measurements by using a single instrument and method, eliminating the need for complex merging of data from multiple devices. HR-ELPI®+ provides real-time measurement of particle concentration and size distribution across a range of 6 nm to 10 µm, with size classification into 14 to 500 size classes at a 10 Hz time resolution.



Dekati® High Temperature HR-ELPI®+

The High Temperature version of the HR-ELPI®+ is a unique instrument capable of measuring high temperature and humid aerosols without dilution, allowing measurements without the risk of sample transformations regardless of the particle concentrations. These features make the High Temperature version of the HR-ELPI®+ the perfect choice for aerosol measurements in the different CCS process stages.

The system also collects physical particles in 14 size fractions during the measurements. As such, the particles can be further analyzed using chemical or physical methods to define the particle composition. The Dekati® HT-HR-ELPI®+ is widely used in demanding industrial plant and process environments, showcasing its reliability and durability.

Optional analysis plates allow to collect particles in the impactor of the HT-HR-ELPI®+ in 14 separate size fractions for later microscopical or chemical analysis

Particle size range	0.006 – 10 µm
Number of size classes	100 or 500 (30 or 150 per decade)
Sample flow rate	10 lpm
Sample temperature	10 – 180 °C
Sampling rate	10 Hz
Weight	32 kg
Dimensions	H410 x W700 x D300 mm
Pump requirements	20 m^3/h @ 40 mbars

	CCS Process stage	Measurement	Instrument(s)
1	Flue gas inlet	Baseline particle load	(High-Temperature) HR-ELPI®+, HT-DLPI+ Impactor eDiluter™Pro
2	Absorber outlet	Aerosol formation & entrainment	High-Temperature HR-ELPI®+, HT-DLPI+ Impactor
3	Mist eliminator outlet	Demister efficiency check	High-Temperature HR-ELPI®+
4	Stripper	Degradation aerosol check (R&D)	High-Temperature HR-ELPI®+
5	Stack emissions	Compliance Nitrosamines monitoring	High-Temperature HR-ELPI®+, HT-DLPI+ Impactor
6	Post CO_2 extraction	CO_2 purity control	(High-Temperature) HR-ELPI®+
7	CCS Plant workplace environment	Exposure & safety	(HT-)DLPI+ Impactor

Overview of Dekati® aerosol measurement instrumentation used in CCS process control and development

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Dekati®
Gravimetric Measurements

Dekati®
High-Temperature DLPI+
Low Pressure Impactor

The DLPI+ (Dekati® Low Pressure Impactor) is a 14-stage cascade impactor that is used to determine airborne particle mass size distribution. The DLPI+ classifies and collects particles into 13 size fractions in the range of 16 nm - 10 µm. In each size fraction, the particles are collected on 25 mm collection substrates that are weighed before and after the measurement to obtain gravimetric size distribution of the particles. Furthermore, a post-measurement chemical or microscopical analysis of the size classified particles can also be performed to determine their composition. The High-Temperature version of the DLPI+ can be heated up to 180 °C for direct sampling of high temperature aerosols.

Nominal flow rate	10 lpm
Sample inlet temperature	0-180 ºC
Pump requirement	20 m^3/h at 40 mbar (abs)
Dimensions	H410 x W290 x D330
Weight	12.8 kg

Dekati® High-Temperature HT-DLPI+

Dekati®
Sampling Systems

Dekati® eDiluter™ Pro

The Dekati® eDiluter™ Pro is a portable dilution system that allows easy sample conditioning for a wide range of particle measurement applications. Its compact structure includes a two-stage dilution system with an adjustable total dilution factor ranging from 1:25 to 1:900. Diluted sample can also be extracted directly after the first dilution stage.

Dekati® eDiluter™ Pro

Dilution factor	1:25 – 1:900, adjustable
Sample inlet/outlet pressure ratio	0.90–1.50
Max. sample inlet temperature	600 ºC (up to 1200 ºC with optional High-Temperature probe)
Inlet sample flow	2-10 lpm, depending on dilution factor
Diluted outlet sample flow	50-80 lpm
Dilution air	Clean and dry dilution air, 5-7 bar abs., max 200 lpm
Dimensions	H205 x W168 x D520 mm
Weight	7.3 kg

For more information, please contact: sales@dekati.com

DEKATI Since 1993

Dekati Ltd. is a world leader in designing and manufacturing innovative fine particle measurement solutions. We have over 30 years of experience in providing measurement instruments and complete measurement solutions to a wide variety of environments and sample conditions. All Dekati® Products are developed and manufactured in Finland and are available with up to five-year warranty.

CERTIFIED ISO 9001 BUREAU VERITAS

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