

THE ULTRA-CLEAN GAS CLEANUP PROCESS FOR INTEGRATED GASIFICATION COMBINED CYCLE (IGCC)

PRIMARY PARTNER

**Siemens Westinghouse Power
Corporation**
Pittsburgh, Pennsylvania

Novel Gas Cleaning/Conditioning for IGCC

PARTICIPANT

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Des Plaines, Illinois

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Description

Coal-based gasification generates hydrocarbon gases that can be applied for the synthesis of chemicals or liquid fuels, and for fuel cell power generation, if extensive deep gas cleaning is performed. Conventional cold gas cleaning technologies (such as Rectisol or amine-based systems) for this duty are expensive and may limit the feasibility of coal usage for such applications. Siemens Westinghouse Power Corporation with the Gas Technology Institute is working on an "Ultra-Clean" gas process for polishing the sulfur, halide, and particulate content of syngas, following bulk gas cleaning so that very stringent gas cleaning requirements could be met in a cost-effective manner. The bulk gas cleaning could be achieved by single-use sorbent additions to gasifiers during gasification of hot syngas through beds of regenerable sorbents. In the latter instance, these sorbents are invariably metal oxides which are converted to sulfides during a sulfur loading stage under reducing hot syngas conditions, and then regenerated by oxidation of the sulfides to oxides to produce a concentrated byproduct stream of sulfur dioxide. Sorbents based on zinc oxide (ZnO) have emerged as the leading candidates for gasification application and are gaining commercial acceptance.

The Ultra-Clean gas polishing process follows bulk gas desulfurization. The bulk-desulfurized gas contains HCl 100 to 500 ppmv, H₂S 20 to 50 ppmv, and particulates 10,000 ppmw. It has two sorbent injection cleanup stages in series, to reduce the concentration of the primary gaseous contaminants to about 1-3 ppmv level in a first stage, a moving-bed filter-reactor, and then to the required level (H₂S < 60 ppbv, HCl < 10 ppbv, particulate < 0.1ppmw) within the second stage, a barrier filter-reactor.



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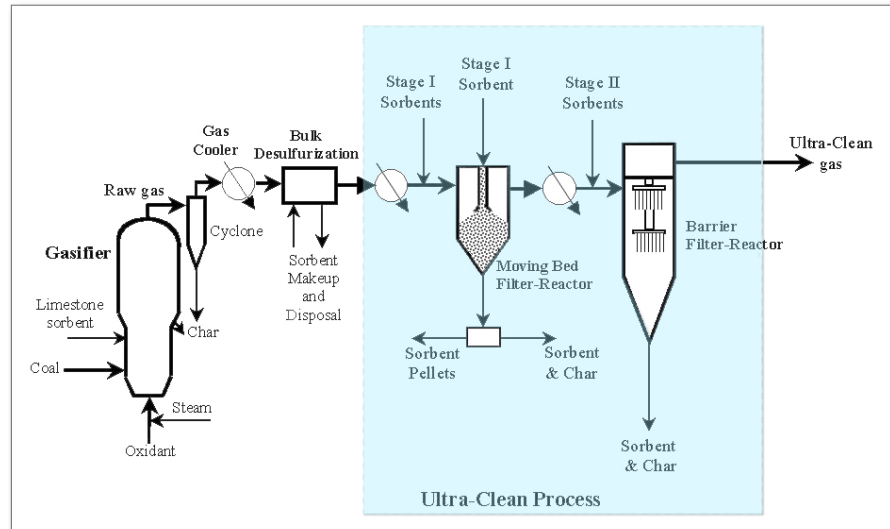
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Goals

The goal for this process is to remove the contaminants from the syngas to the required ppb level (i.e., $H_2S < 60$ ppbv, $HCl < 10$ ppbv, particulates < 0.1 ppmw).

Benefits

The proposed Ultra-Clean Process (UCP) has the potential for performance advantages and economic benefit for the cost-of-gas-cleaning of at least 20 percent, relative to conventional (Rectisol) gas cleaning technology. This potential arises from the following:

1. The UCP is a high-temperature (around 260-530 °C) gas cleaning process that provides overall efficiency gains over cold gas cleaning systems.
2. The process includes, as the final gas cleaning stage, a ceramic barrier filter that provides complete particulate control for the gasification plant — no intermediate barrier filter is required.
3. The advanced ceramic barrier filter system used in this process will be cheaper than the ceramic barrier filter in a current, state-of-the-art hot gas cleanup process for gasification because the moving bed filter-reactor used in the process reduces the ash burden on the ceramic filter, and the sorbents injected into the ceramic filter provide a filter cake having much higher gas permeability.
4. Potential cost advantages also arise because of the ability to optimize the sulfur and halide cleaning duties of the gasifier, the existing polishing cleanup system, and the UCP.