

Honeywell

**TRANSFORMING
CARBON-FLUORINE BONDS
INTRODUCING
HONEYWELL CFX™
TECHNOLOGY**

U P

Honeywell
UOP

HONEYWELL CFX™ TRANSFORMATIONAL TECHNOLOGY

INTRODUCTION

Anticipated EPA and DoD regulations may lead to changes in operation as well as additional costs for a range of businesses, including waste management, chemical & refining industry, municipalities, and other government organizations. Honeywell UOP has over a century of experience solving the world's toughest challenges and has now developed a cost-effective, secure & reliable technology that enables efficient and permanent C-F bond transformation. Our innovative approach ensures compliance with existing regulations and Honeywell is committed to be your partner through any future regulations in this space. Our solution minimizes the environmental impact by eliminating the need for hazardous chemical storage.

WHAT IS HONEYWELL C-F BOND TRANSFORMATION TECHNOLOGY?

Honeywell's C-F Bond Transformation technology is an advanced oxidation solution that allows >99.99% transformation efficiency. Our solution is capable of long-term, stable & reliable operation at temperatures up to 1400 °C, driven by a patent pending process and control system. The technology is feed composition agnostic and can handle broad mixtures of organic and inorganic waste classes in gas, liquid, and slurry forms.

As a fully automated unit that does not require intervention under normal operating conditions, Honeywell CFX™ technology eliminates the need for off-site waste hauling and handling. It is designed to operate either as a standalone unit intaking untreated waste streams, or as a dedicated destruction mechanism, fully compatible with any legacy and future water pre-treatment technology.

Honeywell CFX™ technology is especially beneficial to those looking for a long-term solution for treatment of landfill leachate, industrial waste streams, AFFF as well as SAFF-, RO-, and IX-derived concentrates.

Honeywell CFX™ technology is based on Honeywell's foundational waste management expertise that has over 30 years and 350 deployments globally of proven, reliable, and efficient operation. Most important for our customers: our equipment has a proven track record of meeting compliance obligations regardless of region, jurisdiction, or mandate.

KEY BENEFITS:

1. **Highly efficient:** allows >99.99% transformation efficiency.
2. **Extensive Warranty:** ensuring compliance with all local, state, and federal regulations
3. **Cost-Effective:** Our extensive commercial experience & reputation combined with our technology's exceptional reliability & minimal maintenance requirements enable predictable & cost-efficient operation, 24/7/365.
4. **Feed Composition Agnostic:** Unlike alternative solutions, Honeywell technology is feed composition agnostic, capable of transforming C-F bonds in gas and liquid mixtures as well as certain types of slurries.
5. **Zero liquid waste discharge option:** for customers with limited access to water treatment facilities, Honeywell offers zero-liquid effluent option that eliminates all liquid waste streams from the unit operation.

THE HONEYWELL ADVANTAGE

At Honeywell, we are uniquely positioned to serve customers worldwide in achieving their sustainability goals. By supporting the global transition towards renewable energy and a low-carbon economy, we're accelerating a more sustainable future – and changing the way the world works. We offer a wide spectrum of solutions and technologies that can help you reach your sustainability goals. From Battery Energy Storage Systems and Renewable Fuels to Hydrogen and Carbon Capture Technology and Advanced Plastics Recycling, and from our Gas Renewable portfolio and Smart Energy offering to our technologies for Buildings, Aviation, and Safety and Resilience, the Honeywell solutions reflect our commitment to the world's toughest sustainability challenges. CFX™ versatility and flexibility coupled with a modest operational cost over the lifetime of the unit makes. Honeywell technology is a compelling solution for our customers.



WHY HONEYWELL UOP?

1. 30+ years of successful technology operation with 350+ deployments globally
2. 12 sold C-F bond-specific destruction systems
3. Demonstrated equipment long-term reliability & performance
4. Feed type - & source-agnostic, gas, liquid & slurry compatible
5. Designed for CF_4 conversion into naturally occurring minerals
6. 99.99+% conversion enabled by a patent-pending process & control system
7. Zero liquid waste discharge option available
8. Stable long-term operation at temperatures up to 1400 °C
9. Automated units with minimal maintenance
10. 1 – 1000 gph capacity

CASE STUDY 1: FLUORINE AND CHLORINE CONTAINING COMPOUND WASTE FEED TREATMENT

Honeywell has designed, shipped, and started up multiple Halogen (F, Cl, Br, I,) focused units, and 12 specifically designed for Fluorine compounds. These units are all operating and meeting design parameters with the longest service being 20+ years without major maintenance or upgrades to the system. Currently, specific to the Chlorine/ Fluorine combination, there are multiple units that have been operating for 8+ years without major maintenance and only inspection during normal plant downtimes. The longest running ones are in North America and Asia.

CASE STUDY 2: MAJORITY HALOGENATED WASTE STREAM TREATMENT

The halogen-focused units that Honeywell UOP has designed range in halogen concentration up to ~70% organic halogens. The flue gas properties range up to a total of 5 %vol of acids and corrosive gases such as HCl, Cl₂, HF, F₂, HBr, etc. These units are designed to absorb and recover or scrub, neutralize, and remove the acids to meet all air permit requirements, typically below 10 ppm dry corrected O₂. The actual performance of the units met all air permit requirements and show acid concentrations out of the system as low as <1 ppm depending on the actual operation at time of emission test.

CASE STUDY 3: HARMFUL ACID GAS STACK EXHAUST EMISSION MANAGEMENT

When dealing with halogens, acids are produced, and these must be treated. Treatment, for example, includes either collecting & recovering or scrubbing & neutralizing the feed. The latter case leads to halogen sequestration in the form of naturally occurring mineral salts. Honeywell UOP has experience with dozens of different advanced oxidation and scrubber unit configurations to exactly match process needs. Trays, random packing, gas phase neutralization, collection, and neutralization of submicron acids - all of these designs and options have been provided and are successfully operating in the field.

CASE STUDY 4: FEED FLEXIBILITY – VARIATION IN FEED PROPERTIES AND THROUGHPUT

Honeywell UOP has applied our technology to over 350+ sites and applications that range from light slurry solids all the way to gaseous feed treatment. These waste streams contained halogens, sulfur and thousands of different chemicals that had to be treated at the same time. Honeywell UOP's experience enables our flexibility to adjust to any form incoming waste, develop or optimize a system that will deliver the highest level of efficacy while meeting emission requirements even under variable waste stream conditions.

CONCLUSION

In contrast to experimental-scale concepts, Honeywell presents a commercially validated, cost-effective solution that transforms waste to naturally occurring minerals.

With a market-ready presence, Honeywell is dedicated to ongoing advancements, ensuring customers access top-tier technology for resolving this challenge effectively.

HONEYWELL UOP PROFILE

- 100+ years of global expertise
- R&D powerhouse
- Broadest range of downstream refining and petrochemicals technologies
- Leading process technology licensor
- Invented many of the refining technologies in use today
- 40% of revenue from products introduced in the last five years



NEW TECHNOLOGIES

Honeywell UOP creates new technologies that convert oil and natural gas into transportation fuels, energy and petrochemicals

2,000

Engineers and scientists



UOP TECHNOLOGY MAKES MORE

than 60% of the world's gasoline, 70% of its polyester, and 90% of biodegradable detergents, and processes more than 40% of its LNG

4,900

Active patents and applications



EXPERTISE

UOP has a century-long record leading technology development for the oil and gas industry

LARGEST

process licensing organization
in the world



RELIABILITY

UOP technologies are among the most widely proven in the world

31 out of 36

refining technologies in use today
were developed by UOP



CONTINUOUS INNOVATION

Continuous technology improvement allows customer operations to remain cutting-edge



BETTER ECONOMICS

UOP technologies offer a high return on investment

For more information

For more information, please contact
your UOP representative or visit
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