



POLYCONTROLS

Technologies

Magnesium Melt Protection Alternatives

Conversions case studies

Highlights of the problems encountered and benefits achieved during conversions from SF₆ based cover gas to:

- ❑ SO₂
- ❑ Novec 612™
- ❑ AM-Cover™



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SO₂ - Sulfur Dioxide

SO₂



Gas mixer for a plant wide application – 1500 scfh



SO₂ - Sulfur Dioxide

Problems encountered and solved

1. Gas toxicity

SO₂ is a highly irritating and toxic gas. Thus, security measures have to be implemented:

- ✓ Workers handling SO₂ cylinders must wear protection devices (Safety goggles, shoes, gloves and gas masks)
- ✓ Plant managers have to adapt the emergency procedures
- ✓ Additional training must be given to the personnel



SO₂ - Sulfur Dioxide

Problems encountered and solved ...

2. Temperature issues

SO₂ has a very low vapor pressure (34.4 psig at 21.1°C). Thus, SO₂ needs an external source of heating to increase its vapor pressure.

- ✓ Systems have to be designed for large temperature variation (Especially in Nordic regions)



SO₂ – Sulfur Dioxide

Advantages obtained

1. Very low operation's costs
 - ✓ For a medium casting machine, the SO₂ cost is less than 500\$/year*
2. No GWP



* Based on a 24 hrs/day and 365 day/year operation

SO₂ - Sulfur Dioxide

Advantages obtained ...

3. The price of SO₂ is less volatile than the price of SF₆:

- ❑ Many suppliers (easily available)
- ❑ Many industrial applications such as:
 - ✓ Food preservative for beer and meat,
 - ✓ Refrigerant in ice industry,
 - ✓ Bleaching agent,
 - ✓ Disinfecting in fumigation applications;
 - ✓ Cellulose and paper industries,



SO₂ - Sulfur Dioxide

4. In case of a emergency, the odour of SO₂ provides good warning
 - ✓ A normal person can detect between 3 to 5 ppm per volume of SO₂



Novec 612™

Novec 612™



Gas mixer for 5 medium size die casters



Novec 612™

Problems encountered and solved

1. The Novec 612™ is a speciality fluid. Thus:

- ✓ Price of speciality fluids is more expensive than the price raw/commodity gases.
- ✓ Novec 612 is liquid at room temperature, So it needs to be evaporated in the mixing process



Novec 612™

Advantages obtained

1. Very easy to use

- ✓ Excellent fire protection, only slight amount is required to assure a good protection.
- ✓ Non toxic
- ✓ No need to pay special attention to working conditions (confined spaces, sufficient ventilation and so on)



Novec 612™

Advantages obtained ...

2. Very low GWP (≈ 1)
3. Excellent technical and after sales services by 3M
4. Recently available in premix under the name of MTG Shield (with a price premium)



AM-Cover™

AM-Cover™



Gas mixer for a single die caster



AM-Cover™

Problems encountered and solved

1. Licensing

- ✓ AM-Cover™ is a patented technology. Thus, users need a license
- ✓ Violators will be prosecuted
- ✓ Users have to share production and corporate info with AMT



AM-Cover™

Problems encountered and solved...

2. Intrinsic property of the gas

- ✓ HFC 134a is a refrigerant gas with a low vapor pressure (similar to SO₂). Thus, at low flow (for a single casting machine) it can be handled relatively easily. But, at high flow (for a plant wide system), this gas has:
 - ✓ A propensity to freeze gas components



AM-Cover™

Problems encountered and solved...

2. Intrinsic property of the gas...

- ✓ Gas cylinders need to be heated up to increase their delivery pressure.
- ✓ Gas systems should be immuned against temperature variations. Temperature drops will cause liquefaction in lines. Sensors and others components will need to be disassembled and cleaned manually.



AM-Cover™

Problems encountered and solved...

3. Non negligible GWP ($\approx 1,300$)

✓ Is HFC 134a the next gas to be banned?

4. Price Volatility

✓ Few world wide manufacturers of HFC 134a. Prices have increased and will likely continue to increase.



AM-Cover™

Advantages obtained

1. Equipments can be financed by gas suppliers or CO₂ credits
2. Non toxic for workers



Conclusion

Two solutions have outstanding results:

- ❑ SO₂ for its extremely low cost of operation
 - ✓ Less than 500\$/year per furnaces (1/5 of the SF₆ price)
 - ✓ No GWP
- ❑ Novec 612™ for its easiness of utilization
 - ✓ No hazardous environment for workers
 - ✓ Very low GWP (≈1)



Conclusion

AM-Cover™ is also a proven solution.
But, users have to consider:

- ✓ Licensing fee,
- ✓ Constantly increasing price of HFC 134a
- ✓ Potential ban by the EPA or the European Community
- ✓ Freezing and liquefaction problematic of this gas



Conclusion

Due to the:

- ✓ Toxicity of the SO₂
- ✓ Price of specialty fluids (Novec 612™ and MGT Shield™)
- ✓ High GWP and the increasing price of HFC 134a

➤ All new alternatives require proper controls and monitoring systems.

➤ Older gas conditioning systems need to be replaced



Conclusion

Users have to invest in equipments allowing them to produce:

- ✓ The correct concentration and flow rates
- ✓ A sufficient protection for the personnel (SO₂)
- ✓ An effective mixing in regards to lowering the consumption of active ingredients and specialty fluids (Novec 612™, MGT Shield™ and AM-Cover™)



Conclusion

Those new practices will be simply less damageable for the environment and more economical on the long run.

