Corning Fluorine Abatement System Analysis

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Motivation

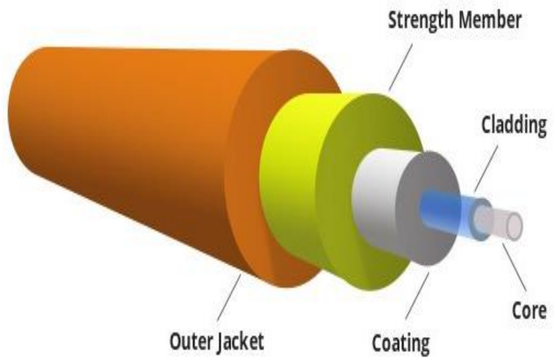
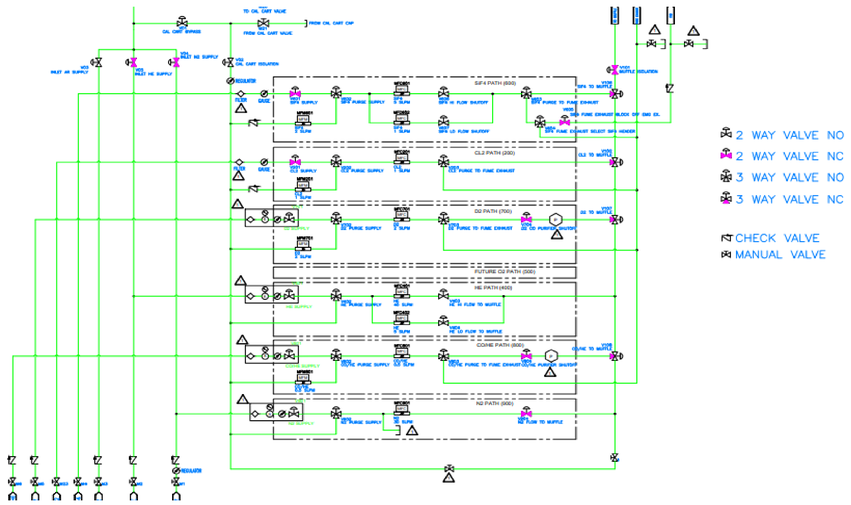


Image courtesy of Corning Inc.

- Optical fiber is essential to many aspects of everyday life, such as data networking and telecommunications
- Sizing the equipment used by Corning is necessary for ensuring the site is using its resources as efficiently as possible
- Current limitation: environmental permits for fluoride output during core manufacturing

Goals

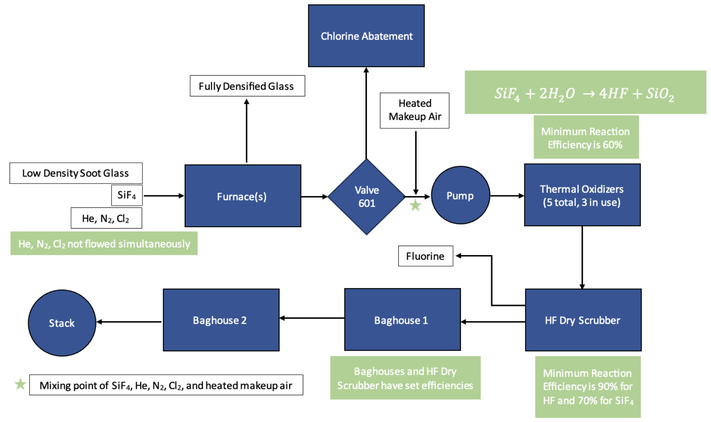
- Streamline mass balance spreadsheet to project inputs, pollutants for current and future manufacturing scale
- Analyze fluorine abatement system
- Link FAB to mass balance to maximize process efficiency with FAB as a limiting factor



Strategy

- Develop mass balance spreadsheet on raw materials
- Calculate FAB system inputs using output data
- Determine headroom of FAB system given current operational parameters

Challenge: Multiple Furnaces, Staggered Uptimes



- Multiple process gases flowing- different times, rates, and abatement systems
- The company needs a summation of SiF_4 flowrates from multiple separate furnaces in real time
- Data had to be analyzed to determine which furnaces were running SiF_4, when, and at what flowrate

Results

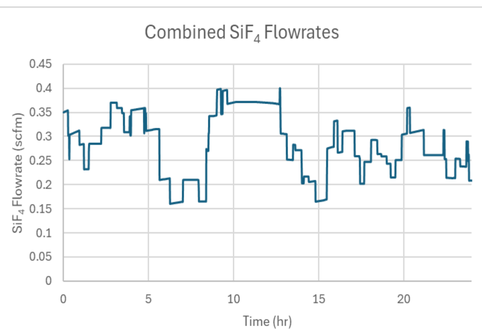
Inputs

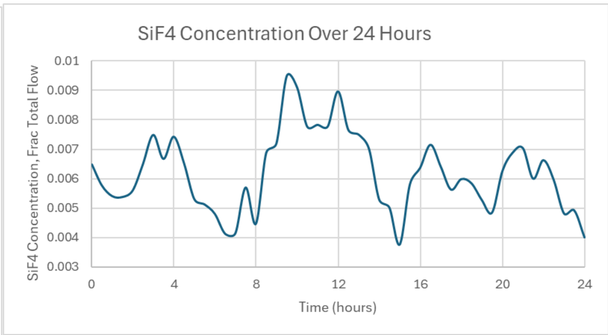
Process variable	Data Set 1	Data Set 2	Units	Definitions
Shutdown Days	5.00	1	days	Days the plant will not be operating
Schedule factor	0.95	1	%	Factoring operational hours into schedule
Utilization	0.90	1	%	Process hours that are run/available hours. Factors in time lost for preheat time, loading time, etc.
Process Rate	300.00	1	km/hr	Rate of production process
Select	0.90	1	%	Percent of selected product without defects
Blank Size	1500.00	1	km	Size of blanks (km). Minus net of root and gob amount
OMCTS Ramp	350.00	1	g/min	Ramp recipe flow setpoint
OMCTS SS	485.00	1	g/min	Steady-state recipe flow setpoint
Root & gob	6075.00	1	g	Estimated weight value
Cane Weight	1.00	1	g	Weight of a single cane
Consolidation Select	0.95	1	%	Good mass of product/mass of product produced
NOx generated per Blank	11.30	1	lbs/blank	Weight of NOx per a blank
Annual Target Capacity	100000000.00	1	Mkm	Annual Target Capacity
Cane Diameter	2.53	2.7	cm	Diameter in cm of a glass cane

Outputs

Process Variable	Data Set 1	Data Set 2	Units	Definitions
Good kms	2.00E+00	1.00E+04	Mkm	Length of product without defects
Capture efficiency	68.9	16.7	%	Deposited weight divided by the generated soot.
OMCTS/blank	0.835	0.002	kg	OMCTS mass per blank
Good kms thru furnace per lathe	1.90E+05	1.00E+04	Mkm	Product of the consolidation select and the good kms.
# Lathes needed	6	1	count	Count of lathes needed to make the target plant capacity.
Total site OMCTS	6.68E+06	2.00E+04	metric tons	Total site OMCTS converted to mTons.
NOx	4.11E+10	4.60E+09	kg/site/yr	Rounding up of NOx for numerical simplification (used EXCEL roundup function)
Metric tons NOx	4.11E+07	4.60E+06	metric tons	Unit conversion from kg/site/yr to mTons
Mkm Glass capacity	1.14E+07	1.00E+05	Mkm	The maximum length in which glass can be stretched
NOx emission rate	5.57E+06	5.30E+05	g/hr NOx (as NO2)	The final emission rate of NOx through optical fiber production process
Core Canes required	1480	8760	count	Cane assemblies required to make the targeted kilometer volume (net of in-process losses)
OMCT Site Consumption per Week	130000	1000	metric tons/ week	
Cane Weight	2785	3090	g	Weight of a single cane

- Consolidated mass balance spreadsheet
- Features dropdown for user-friendly data comparison
- 24-hour analysis of FAB system usage during manufacturing





Conclusions and Recommendations

- FAB analysis shows plant is still operating within permitted limits and can increase manufacturing scale with current system
- Full-system in-kind addition cost = ~$20 million; adding limiting components would cost ≥50% less
- FAB system is far too understudied to be replicated; further characterization is warranted, starting with this study