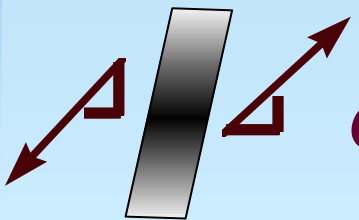
A Tailor-Made Membrane for SF_6 Recycling: An Environmentally Friendly Method To Reduce Costs.

Gil Dagan, Giora Agam, Vitaly Krakov, Len Kaplan,
Carbon Membranes Ltd, Israel.



ACKNOWLEDGMENTS:

Dr. A. Soffer

Natalia
Larisa

And all the other devoted members of the CML team...

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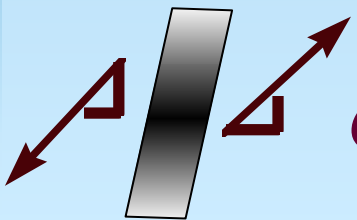

…To Reduce Costs.

For 1 m^2 melt surface,
(assuming 100 liters enclosure volume)
SF_6 consumption is about 10 g per hour.

In other words,

for every 1 m^2 melt surface,
25 cents goes up in smoke every hour…

$

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The whole Mg industry consumes
many millions of dollars worth of SF_6 a year…

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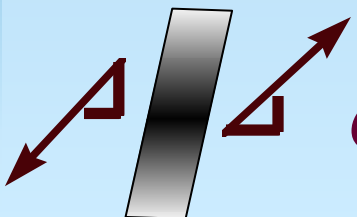
…An Environmentally Friendly…

SF_6 global warming potential is 24,900 times greater than that of CO_2…



And what about moving back to SO_2?

DANGER!

SO_2 has a TLV of 2 ppm (!).

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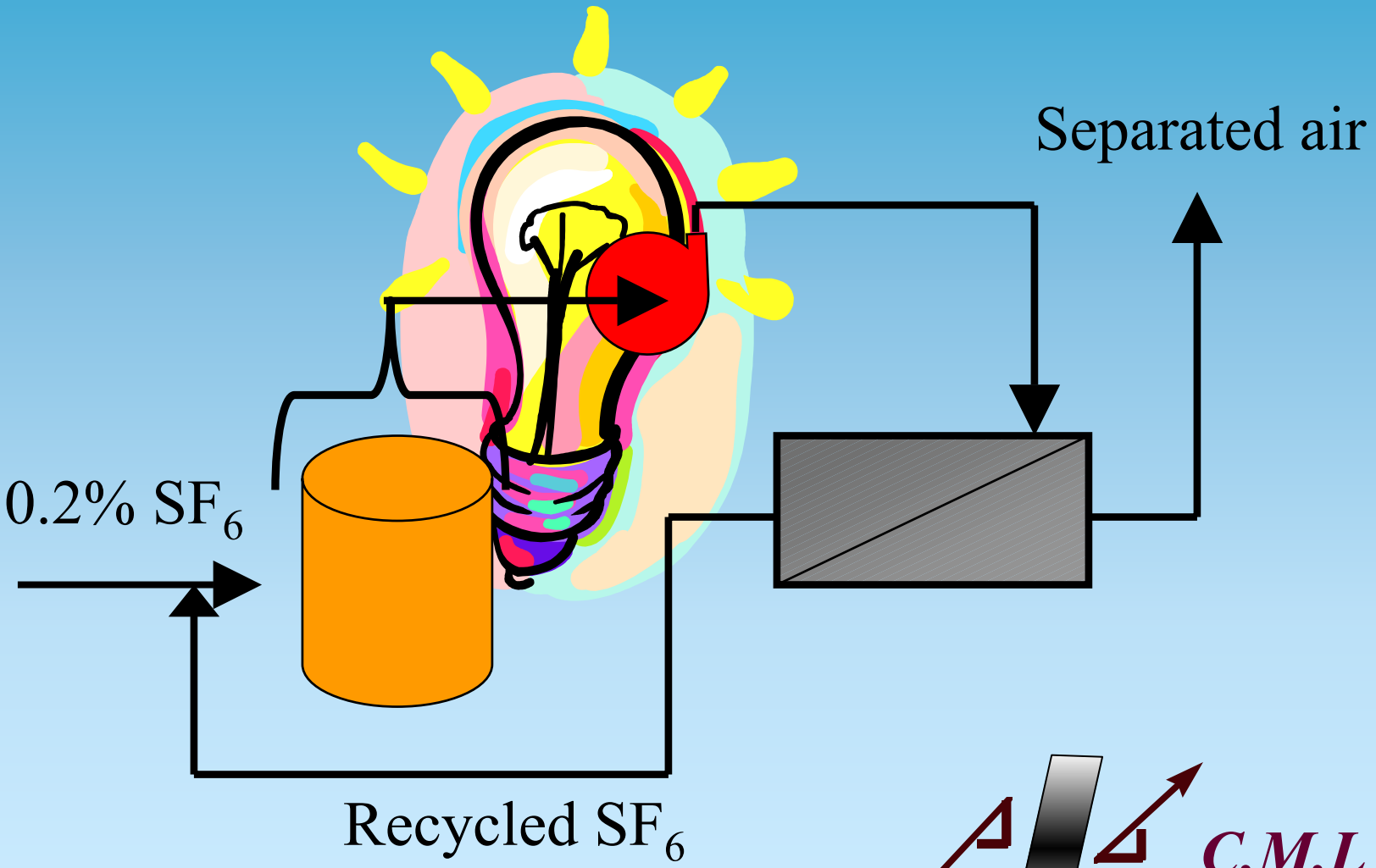
...for SF_6 Recycling:



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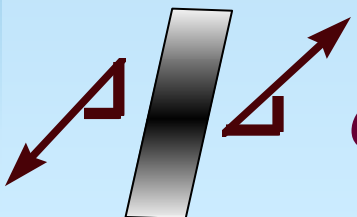
A Tailor-Made Membrane for SF_6…

How is it produced and tailored?

How does it work?

How efficient is it?



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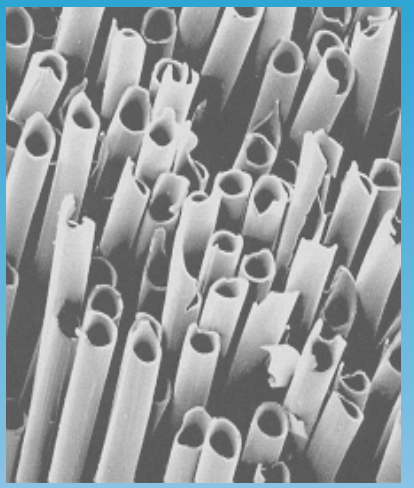

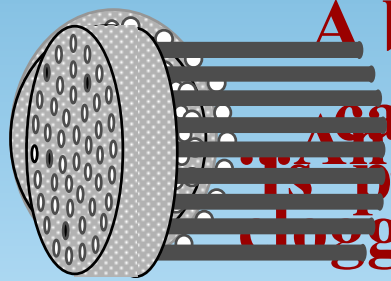

A bundle of carbonized fibers

Any broken fibers a

Is potted together

Jagged and so neutra

To form one coherent separation module

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Such modules are currently composed of:

100 fibers (0.02 m^2)

or

1,000 fibers (0.2 m^2)

or

10,000 fibers (4 m^2)

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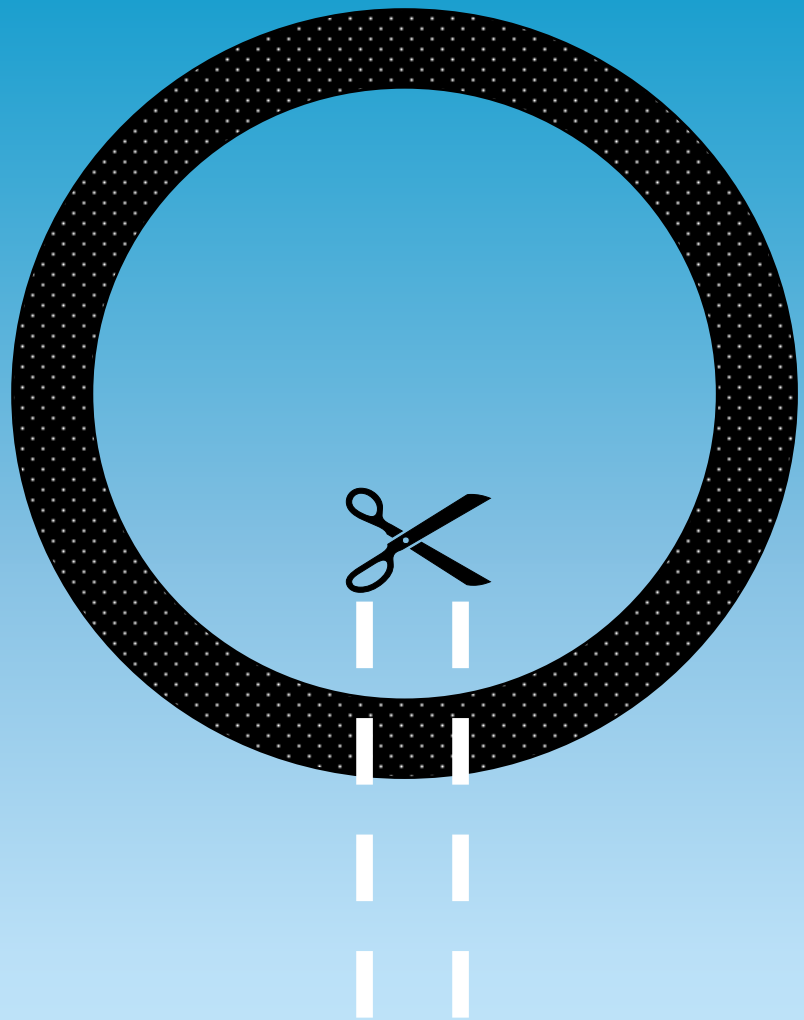
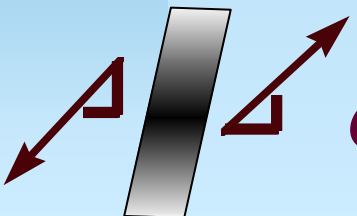


Controlling the pore size distribution



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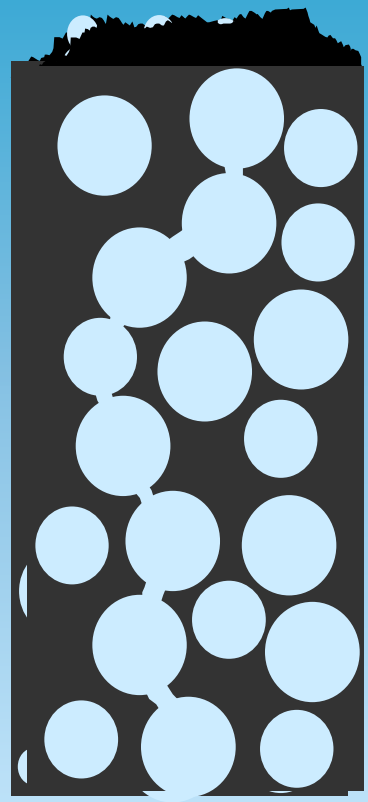

Fiber cross section,
After pore opening
After CVD Coating
After carbonization

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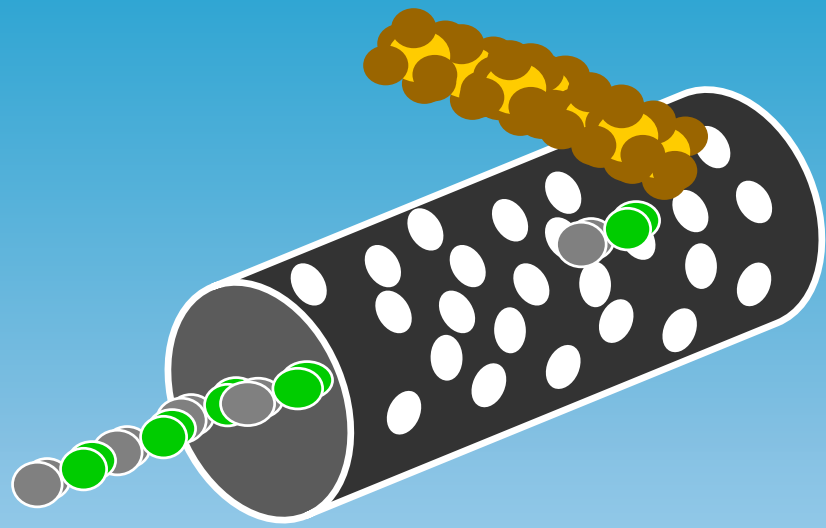

Molecules diameter		
O_2		3.2Å
N_2		3.6Å
SF_6		5.02Å

The molecular sieving separation mechanism

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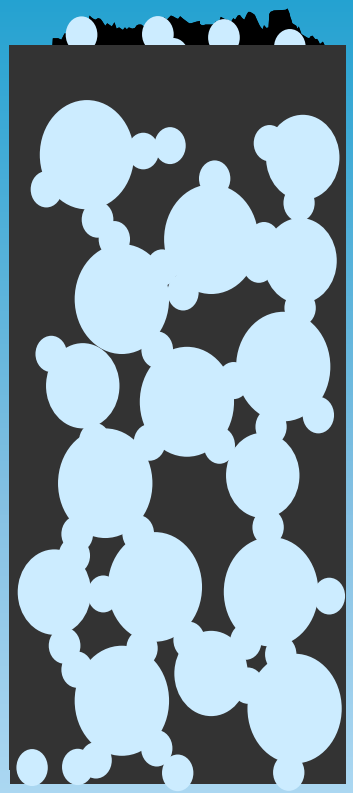

High flux of small molecules

Complete retention of big molecules

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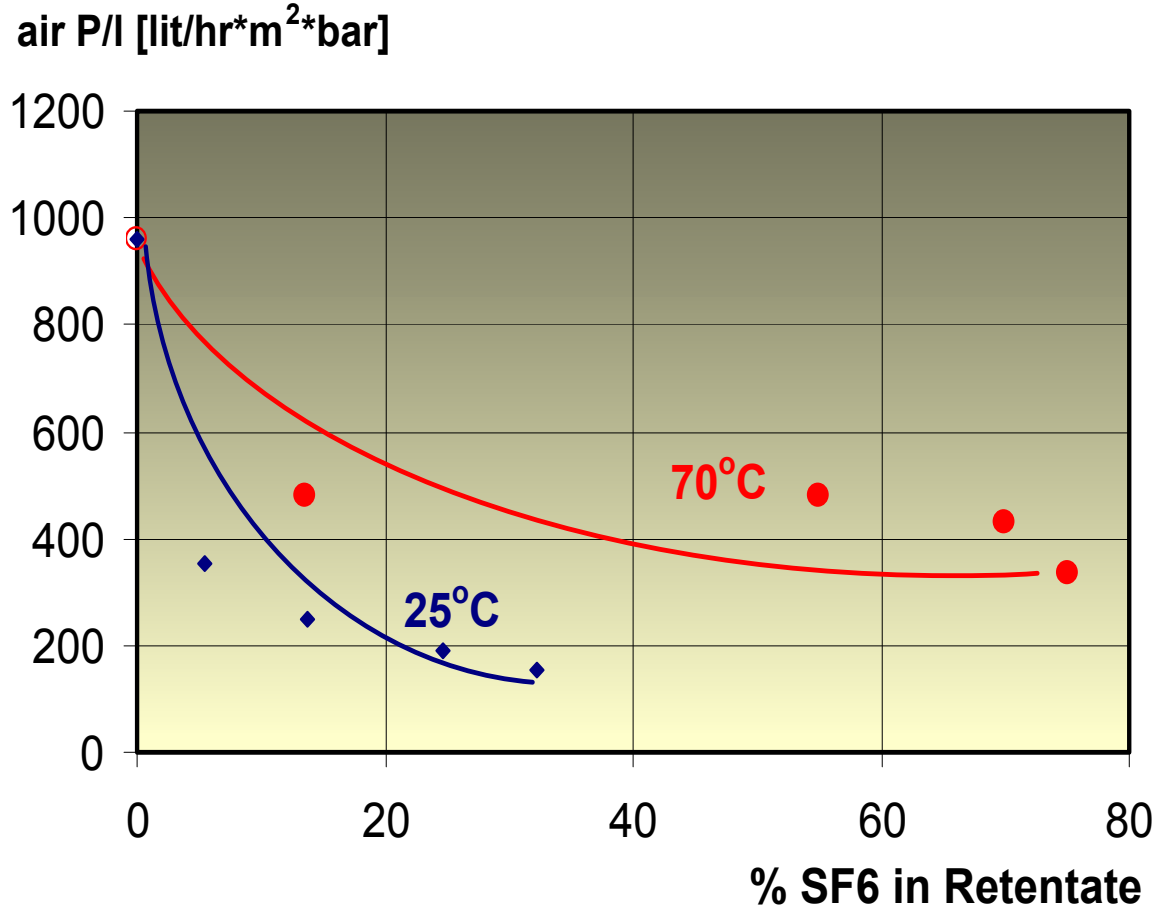

Fig. 2: Air P/l vs. % SF_6 at different temperatures

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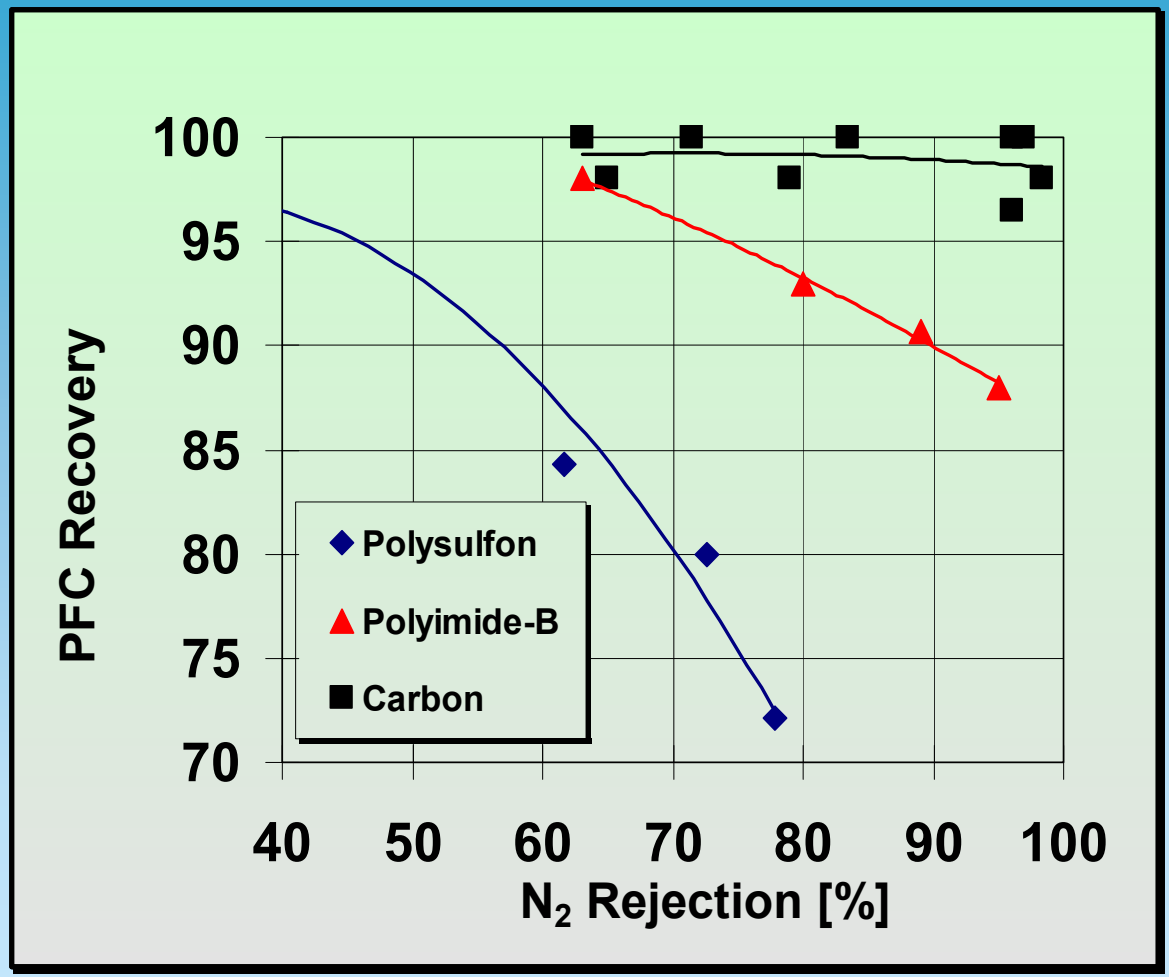
PFC Recovery
100
95
90
85
80
75
70
40
50
60
70
80
90
100
N2 Rejection [%]
Polysulfon
Polyimide-B
Carbon

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Conclusions:

SF_6's high cost, together with its environmental impact, drives the search for methods to reduce the emission of this gas.

Membranes can efficiently separate SF_6, and thus the design of cost-effective recycling systems is possible.

Carbon molecular sieve membranes have extremely high selectivity. With these membranes more than 99.5% of the SF_6 can be recovered.

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