Deployment in Chemical Vapor Deposition Applications[1]

Table 1: Chemical Vapor Deposition Target

Target Type	MFL (Ours)	Ideal Target
Film thickness (center) [nm]	1047.5	(100, 2000)
Film thickness (edge) [nm]	1147.3	(100, 2200)
Internal stress [MPa]	0.0	0.047
Surface roughness (Ra) [nm]	5.148	(0.1, 10)

Table 2: Chemical Vapor Deposition Input

Input Type	MFL (Ours)	Input Constraints
SiH_4 flow rate [sccm]	317.0320	(50, 500)
NH_3 flow rate [sccm]	560.5539	(100, 1000)
N_2 flow rate [sccm]	1288.5685	(200, 2000)
Chamber temperature [°C]	541.5430	(300, 750)
Chamber pressure [Torr]	5.1651	(1, 10)
Chamber humidity [%RH]	24.6166	(5, 40)
Electrode distance [mm]	16.7863	(10, 30)
Pre-clean plasma power [W]	146.6214	(0, 300)
Pre-clean duration [s]	36.2421	(0, 60)
Wafer rotation speed [rpm]	1906.4441	(0, 3000)
Process time [s]	5.05	144.5516

Deployment in Wire Bonding Applications[2]

Table 3: Wire Bonding Target

Target Type	MFL (Ours)	Ideal Target
Pull strength [gf]	15.005	(5, 25)
Bonding x-offset [µm]	-0.0001	(-20, 20)
Bonding y-offset [µm]	-0.0002	(-20, 20)

Table 4: Table 4: Wire Bonding Input

Input Type	MFL (Ours)	Input Constraints
Bonding pressure [gf]	98.6096	(20, 120)
Bonding time [ms]	19.9200	(1, 30)
Temperature [°C]	240.9897	(100, 300)
Wire diameter [µm]	28.0635	(15, 33)
Wire length [mm]	3.2536	(0.5, 5.0)
Pad diameter [µm]	88.7107	(50, 150)

The applications in chemical vapor deposition and wire bonding are beyond the semiconductor recipe generation, these results highlight the generality and adaptability of our method across diverse tasks in different domains. We believe this extension demonstrates the broader applicability of our method.
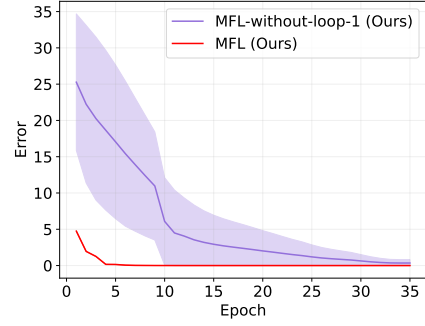
Ablation Experiments

Figure 1: Ablation experiments: comparison between MFL and MFL without loop 1 training.
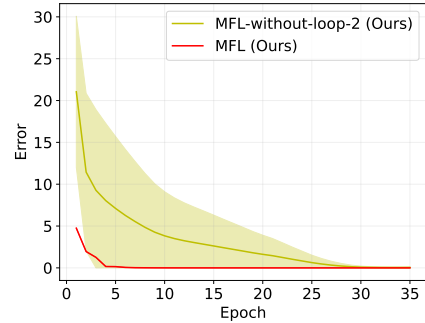

Figure 2: Ablation experiments: comparison between MFL and MFL without loop 2 training.
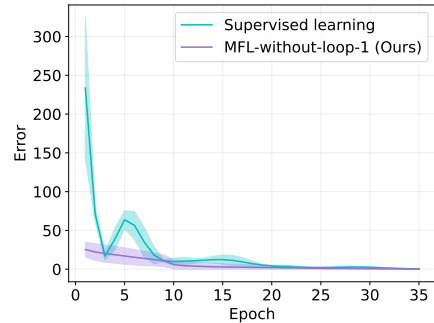

Figure 3: Ablation experiments: comparison between MFL without loop 1 training and supervised learning.

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[1]https://en.wikipedia.org/wiki/Chemical_vapor_deposition
[2]https://en.wikipedia.org/wiki/Wire_bonding