Table S1. Demand-based powder refreshment strategy.

Build ID	Virgin Powder Added* [kg]	Build ID	Virgin Powder Added [kg]	Build ID	Virgin Powder Added [kg]	Build ID	Virgin Powder Added [kg]
C1	70.0	**C10**	0.0	**C19**	0.0	**C28**	0.0
C2	0.0	**C11**	0.0	**C20**	0.0	**C29**	0.0
C3	10.0	**C12**	0.0	**C21**	0.0	**C30**	0.0
C4	0.0	**C13**	0.0	**C22**	10.0	**C31**	0.0
C5	2.5	**C14**	2.5	**C23**	10.0	**C32**	0.0
C6	0.0	**C15**	7.5	**C24**	0.0	**C33**	0.0
C7	12.5	**C16**	20.0	**C25**	0.0	**C34**	0.0
C8	0.0	**C17**	0.0	**C26**	10.0		
C9	25.0	**C18**	0.0	**C27**	20.0		

**For builds where 0.0 kg is indicated, the machine operated entirely on the recycled powder present in the closed-loop system from the previous build*

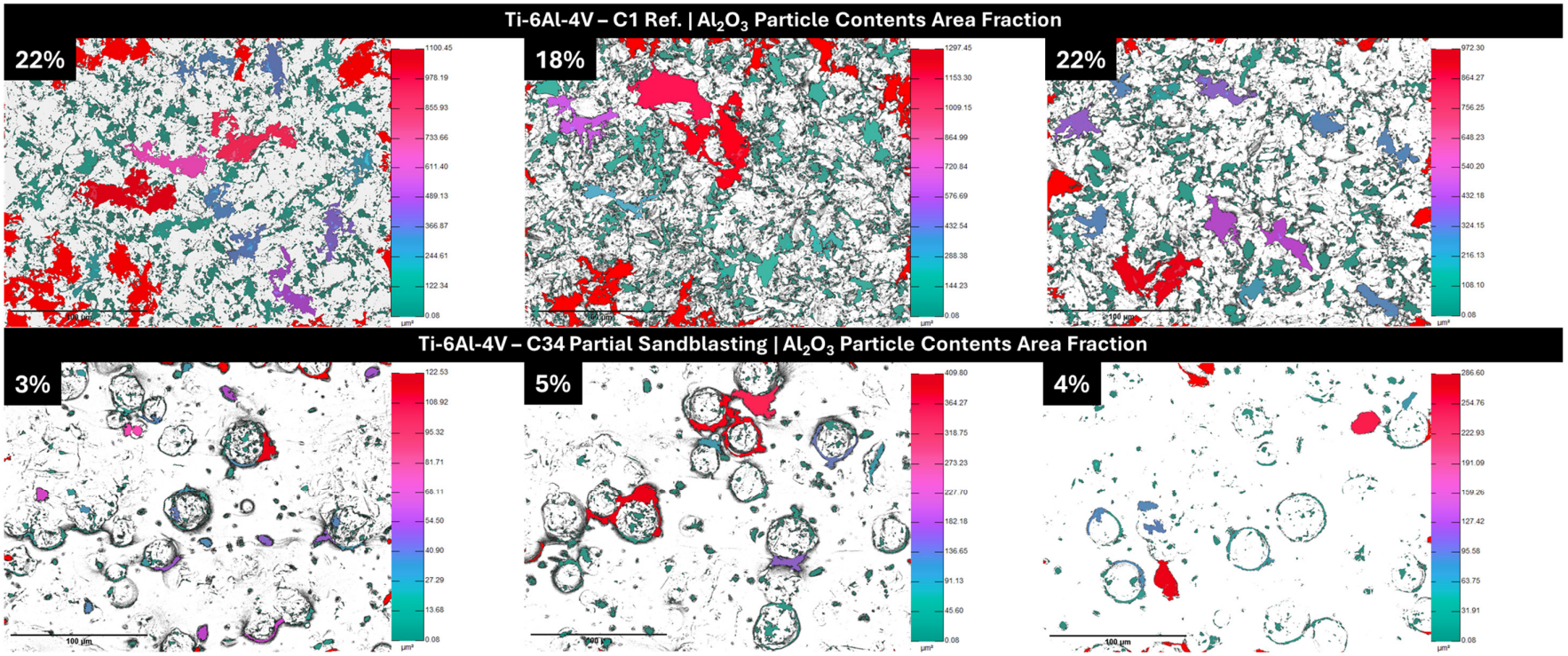


Figure S1. Estimated Al_2O_3 surface area occupancy on samples C1 and C34, obtained from SEM images using ImageJ software (version 1.54p). Scale bars represent 100 μm.

Table S2. Al_2O_3 particle size and area occupancy estimation from three randomly selected SEM image sectors per sample.

Sample	Particles [Count]	Total Area [µm²]	Estimated Size [µm]	Area Occupancy [%]	Average [%]	Std.Dev. [%]
C1_1	3758	13110	3.5	22.0		
C1_2	3262	10971	3.4	18.2	**19.0**	2.7
C1_3	2318	10209	4.4	16.9		
C34_1_PSB	1144	2045	1.8	3.4		
C34_2_PSB	1156	3309	2.9	5.5	**4.4**	1.0
C34_3_PSB	1013	2572	2.5	4.3		

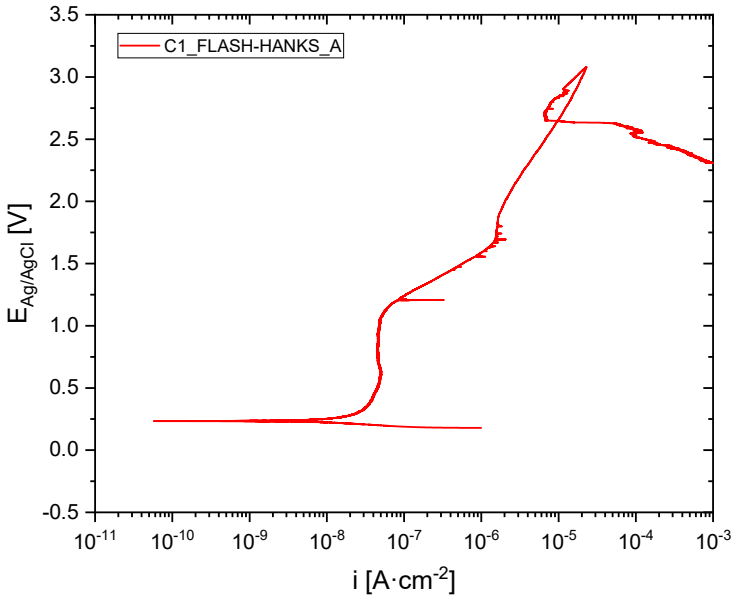


Figure S2. PDP curve for the failed sample of Flash-PEO coated C1 condition.