APPENDIX–I

During the famous FGM program in Japan from 1987 to 1991, several processing methods were developed for FGM parts as a thermal barrier of a space plane. These former methods included powder metallurgy, plasma spraying, physical and chemical vapor deposition, self— propagating high temperature synthesis (SHS) arid galvanoforming. Since 1991, various new methods have been invented and developed. The processing of FGMs has been categorized in different ways in review papers (Mortensen and Suresh. 1995; Neubrand and Redel, 1997: Miyamoto et aL. 1999). As shown in Fig. 1.1.6. Miyamoto et al. (1999) classified the fabrication of FGMs into four categories including bulk. Layer, preform and melt processing.

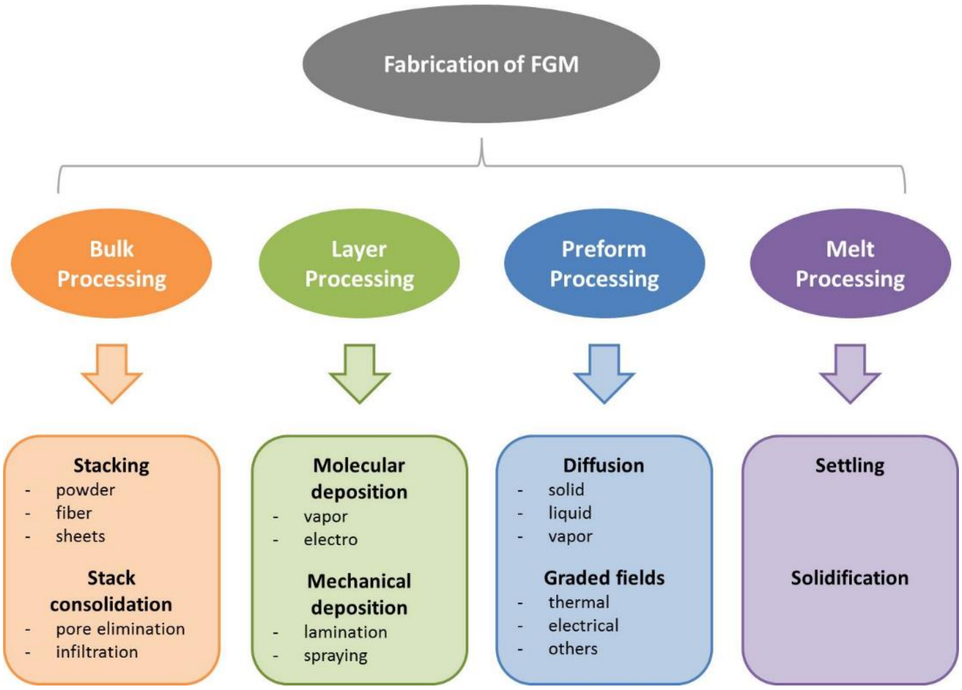

Fig. AI.I-Proceeding methods and classification for fabrication of FGMs.

APPENDIX–II

Thermal Spray Techniques

Thermal spray techniques are very attractive methods of production of FGM coatings as they are suitable for metals and refractory materials. Thermal spray is a generic term for a group of coating processes used to apply metallic or nonmetallic coatings. These processes are grouped into three major categories: flame spray, electric arc spray, and plasma arc spray. These energy sources are used to heat the coating material (in powder, wire, or rod form) to a molten or semi molten state. The resultant heated particles are accelerated and propelled toward a prepared surface by either process gases or atomization jets. Upon impact, a bond forms with the surface, with subsequent particles causing thickness buildup and forming a lamellar structure.

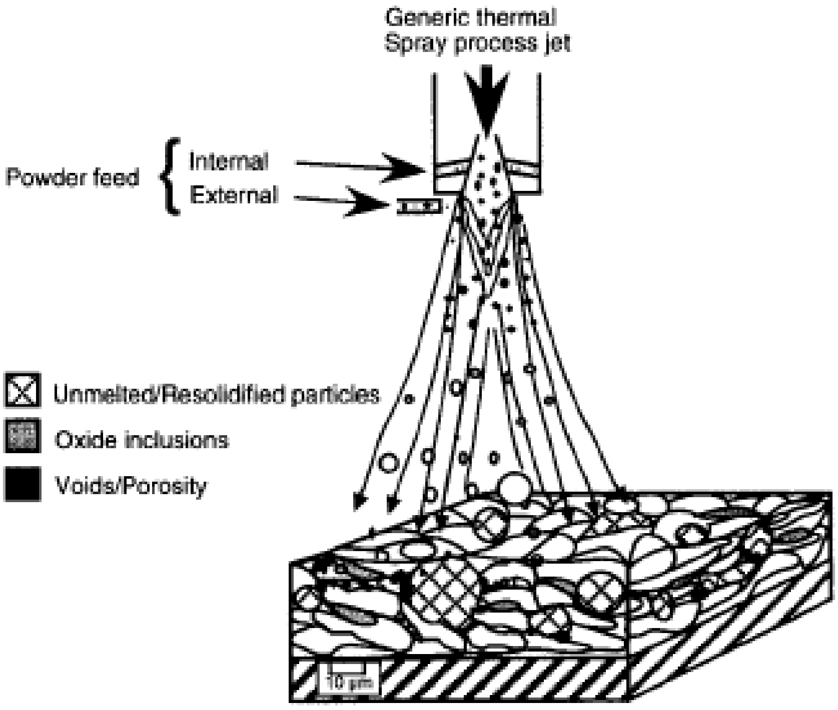

Fig. AII- Thermal spray process

APPENDIX–III

Table. AIII Critical Buckling load of SFG beam resting on linear foundation (n=1, ψ =0.4)

L/h	Normalized Critical Buckling loads (P^*L^2/EI)									
	K_1=0	K_2=0	K_1=300	K_2=0	K_1=500	K_2=0	K_1=500	K_2=0.4	K_1=500	K_2=0.8
2	1.2338		1.3170		1.3724		2.5724		3.7724	
4	0.2164		0.2268		0.2337		0.3837		0.5337	
6	0.0693		0.0723		0.0744		0.1188		0.1632	
8	0.0301		0.0314		0.0322		0.0509		0.0697	
10	0.0156		0.0163		0.0167		0.0263		0.0359	

APPENDIX–IV

Table. AIV Critical Buckling load of SFG beam resting on parabolic foundation (n=1, ξ =0.4)

L/h	Normalized Critical Buckling loads ($P*L^2/EI$)									
	K_1=0	K_2=0	K_1=300	K_2=0	K_1=500	K_2=0	K_1=500	K_2=0.4	K_1=500	K_2=0.8
2	1.2338		1.3236		1.3835		2.5835		3.7835	
4	0.2164		0.2276		0.2351		0.3851		0.5351	
6	0.0693		0.0726		0.0748		0.1192		0.1636	
8	0.0301		0.0315		0.0324		0.0511		0.0699	
10	0.0156		0.0163		0.0168		0.0264		0.0360	

APPENDIX-V

Table.AV Critical Buckling load of SFG beam resting on sinusoidal foundation (n=1, μ =0.4)

L/h	Normalized Critical Buckling loads (P^*L^2/EI)									
	K_1=0	K_2=0	K_1=300	K_2=0	K_1=500	K_2=0	K_1=500	K_2=0.4	K_1=500	K_2=0.8
2	1.2338		1.3171		1.3726		2.5726		3.7726	
4	0.2164		0.2268		0.2338		0.3837		0.5337	
6	0.0693		0.0723		0.0744		0.1188		0.1632	
8	0.0301		0.0314		0.0322		0.0510		0.0697	
10	0.0156		0.0163		0.0167		0.0263		0.0359	

APPENDIX-VI

Table.AVI First mode and second mode normalized frequencies at different power index for linear, parabolic and sinusoidal foundations

n	Normalized frequencies $\eta_i = \omega_i \left(\frac{\rho A L^4}{EI} \right)^{1/2}$ K_1-500, K_2=0.4, L/h=4					
	ψ =0.4		ξ =0.4		μ =0.4	
	η_1	η_2	η_1	η_2	η_1	η_2
0.25	11.8396	21.6175	11.8613	21.6175	11.8401	21.6175
0.5	11.7472	21.5345	11.7690	21.5346	11.7477	21.5345
0.75	11.7180	21.4591	11.7397	21.4593	11.7184	21.4591
1	11.6588	21.3962	11.6806	21.3965	11.6592	21.3962
1.25	11.6038	21.3400	11.6257	21.3403	11.6043	21.3400
1.5	11.5593	21.2935	11.5812	21.2938	11.5598	21.2935
1.75	11.5231	21.2550	11.5450	21.2554	11.5236	21.2550
2	11.4933	21.2230	11.5152	21.2234	11.4937	21.2230
2.25	11.4685	21.1963	11.4905	21.1967	11.4690	21.1963
2.5	11.4479	21.1737	11.4698	21.1741	11.4483	21.1737
2.75	11.4304	21.1545	11.4524	21.1550	11.4309	21.1545
3	11.4156	21.1382	11.4376	21.1386	11.4161	21.1382

APPENDIX-VII

The shape function matrix

$$[\aleph]=\begin{bmatrix} 1-\frac{x}{l} & \frac{6\eta x(x-l)}{l(\beta l^2+12)} & \frac{3\eta x(x-l)}{\beta l^2+12} & \frac{x}{l} & -\frac{6\eta x(x-l)}{l(\beta l^2+12)} & \frac{3\eta x(x-l)}{\beta l^2+12} \\ 0 & 1-\frac{12x-\beta x^2(2x-3l)}{l(\beta l^2+12)} & \frac{\beta x l(x-l)^2-6x(x-l)}{l(\beta l^2+12)} & 0 & \frac{12x-\beta x^2(2x-3l)}{l(\beta l^2+12)} & \frac{\beta x l(x-l)^2-6x(x-l)}{l(\beta l^2+12)} \\ 0 & \frac{6\beta x(x-l)}{l(\beta l^2+12)} & 1-\frac{\beta x l(3x+4l)+12x}{l(\beta l^2+12)} & 0 & -\frac{6\beta x(x-l)}{l(\beta l^2+12)} & \frac{\beta x l(3x-2l)+12x}{l(\beta l^2+12)} \end{bmatrix}$$

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[1] Padhi,S.N., Mohanty,R.C. and Rout,T. "Buckling Of Sigmoid Timoshenko Beam On 2-Parameter Variable Elastic Foundation", International Journal of Engineering Technology and Computer Research (IJETCR) 4 (3), 2016, 12–18.

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