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**ساخت سلاح موشک انداز سبک وزن و با عمر شلیک طولانی با
استفاده از کامپوزیت های FML**

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بخش اول: مقدمه

(Forging)

RPG7

MK III 84

MK III 84

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8.5

9000 psi

2.8

3500

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(filament winding)

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$\sigma_{hoop} \quad \sigma_{axial}$

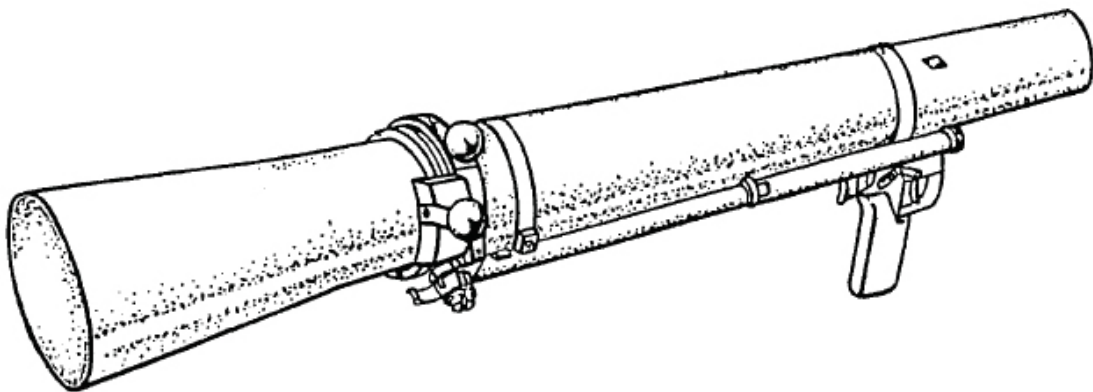
$\theta = \tan^{-1}(\frac{\sigma_{axial}}{\sigma_{hoop}})$

(θ)

8lb_s

71°

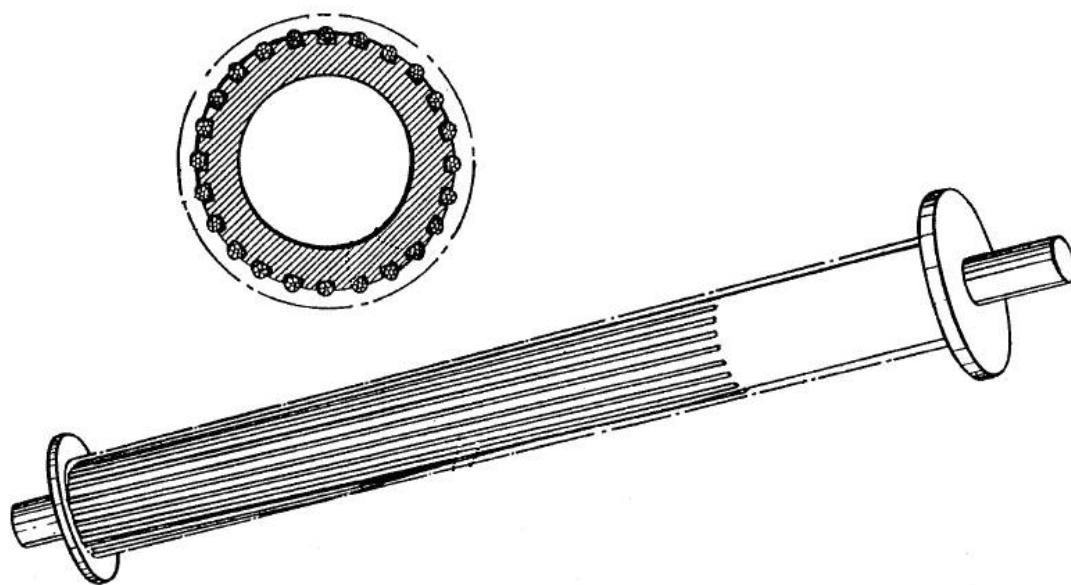
78° 70°



MK III

84

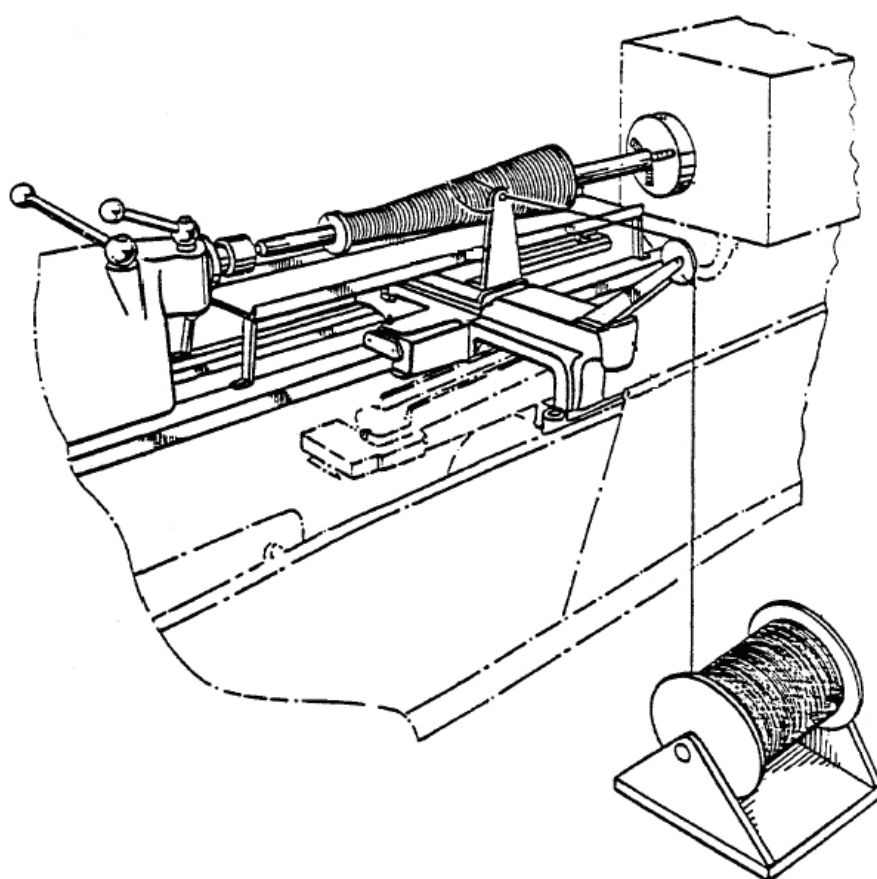
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МК III

84

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МК III

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(helix angle)

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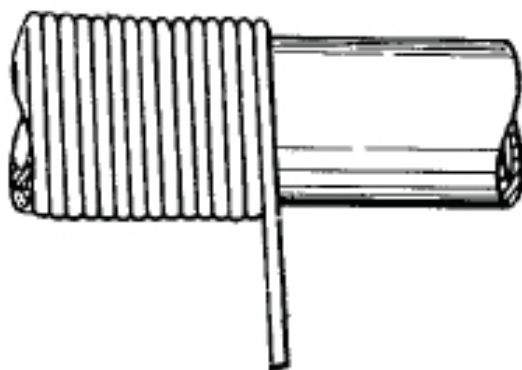
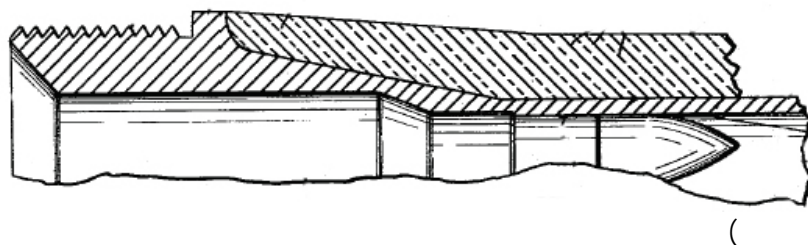
.

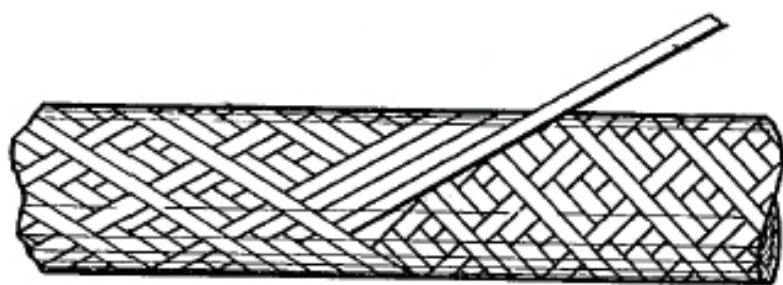
.

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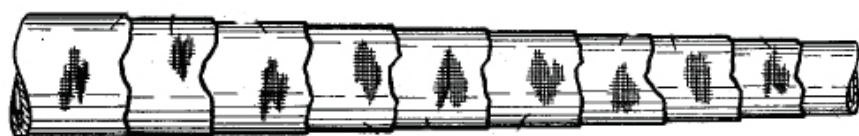
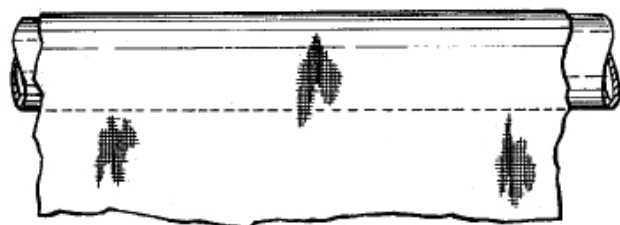
°C

°C





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بخش دوم: معرفی کامپوزیت های FML

FML (Fiber metal laminate)

FML

FML

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(Aramid reinforced Aluminum Laminate) Arall

FML

Prepreg

2024

$$\left(\frac{\delta}{\rho}\right)$$

$$\left(\frac{E}{\rho}\right)$$

2024

FML

(Carbon reinforced aluminum laminate) CARAL (Glass Reinforcement) Glare

GLARE CARAL FML

72Gpa CARAL E_x

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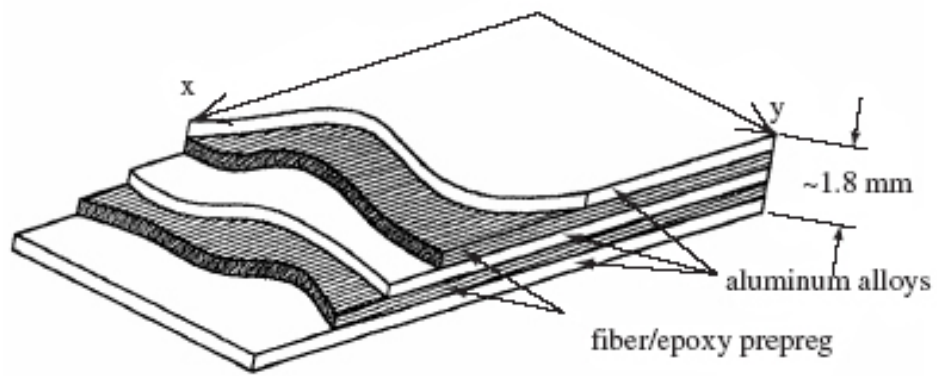
55Gpa Glare

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FML

FML

FML



FML

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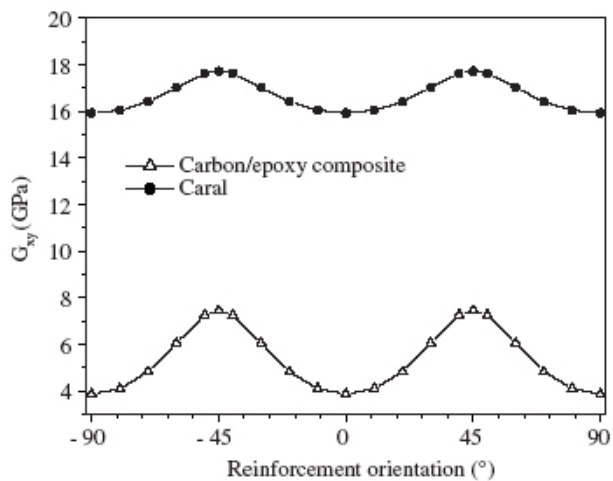
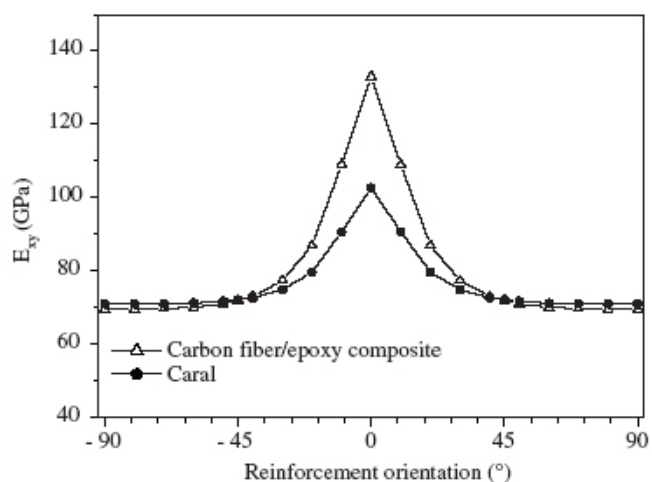
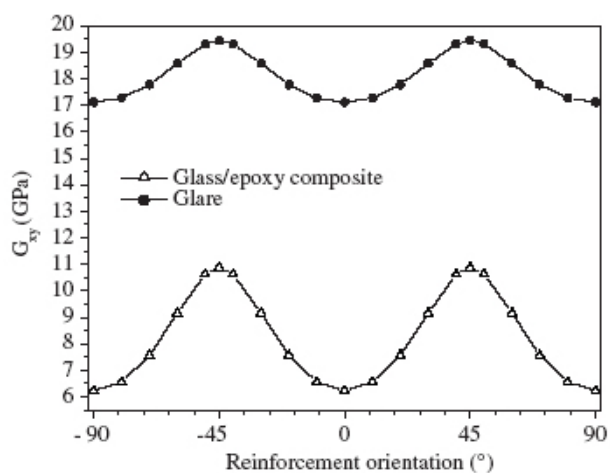
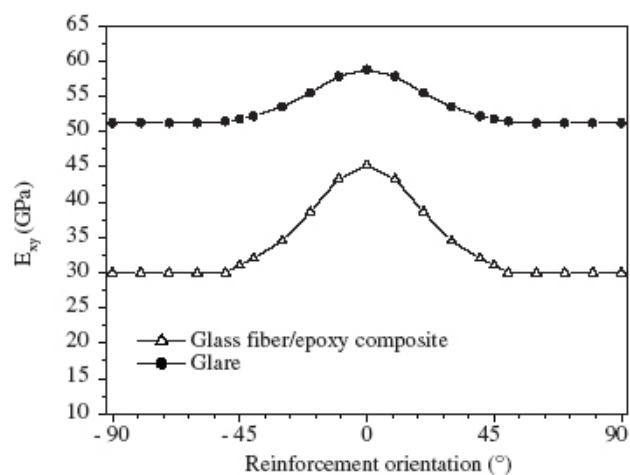
Specimen	Fiber content (%)	Al content (%)	E_x (GPa)	E_y (GPa)	G_{12} (GPa)	G_{13} (GPa)	ν_{12}
Carbon /epoxy	60.0	0.00	71.3	71.3	3.86	3.39	0.03
Glass/epoxy	60.0	0.00	30.6	30.6	6.03	5.72	0.15
Aluminum*	0.00	100	72.4	72.4	28.0	28.0	0.33
Al/carbon/epoxy	25.3	57.9	71.9	71.9	17.8	17.6	0.20
Al/glass/epoxy	25.3	57.9	54.8	54.8	18.8	18.6	0.25

GLARE

CARAL

FML

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FML

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FML

FML

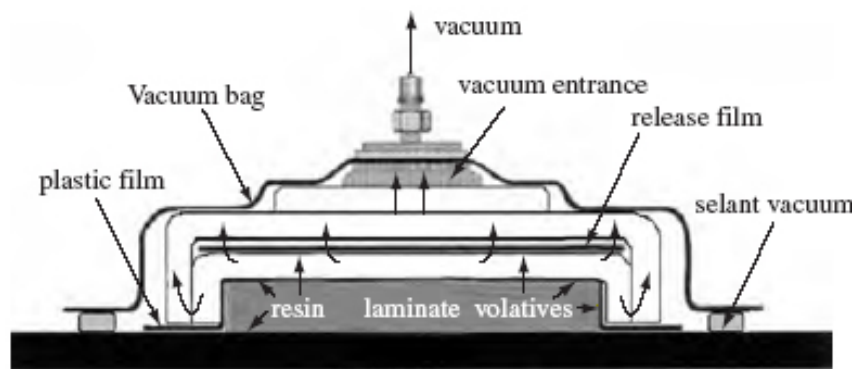
.() () Prepreg

Glare grade	Sub	Al sheet thickness (mm)	Prepreg orientation in each fiber layer	Main beneficial characteristics
Glare 1	-	0.3-0.4 (7475-T761)	0/0	Fatigue, strength, yield stress
Glare 2	Glare 2A	0.2-0.5 (2024-T3)	0/0	fatigue, strength
	Glare 2B	0.2-0.5 (2024-T3)	90/90	fatigue, strength
Glare 3	-	0.2-0.5 (2024-T3)	0/90	fatigue, impact
Glare 4	Glare 4A	0.2-0.5 (2024-T3)	0/90/0	Fatigue, strength, in 0° direction
	Glare 4B	0.2-0.5 (2024-T3)	90/0/90	Fatigue, strength, in 90° direction
Glare 5	-	0.2-0.5 (2024-T3)	0/90/90/0	Shear, off-axis properties
Glare 6	Glare 6A	0.2-0.5 (2024-T3)	+ 45/- 45	Shear, off-axis properties
	Glare 6B	0.2-0.5 (2024-T3)	- 45/+ 45	

FML (

Vacuum

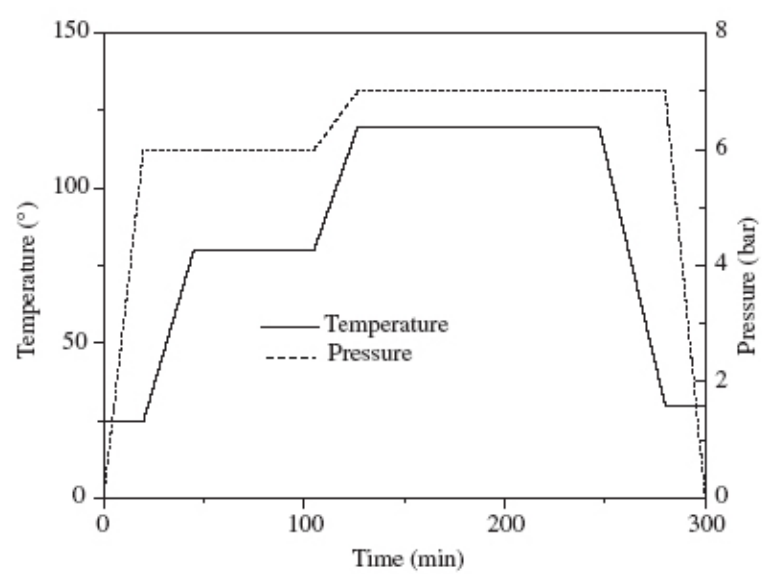
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FML



FML

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بخش سوم: ایده استفاده از کامپوزیت های FML در ساخت سلاح

FML