$$I = \frac{\dot{\varepsilon} \cdot \bar{a}}{\sqrt{\sigma_{33}/\rho_s}}; \mu = \sin(\varphi)$$

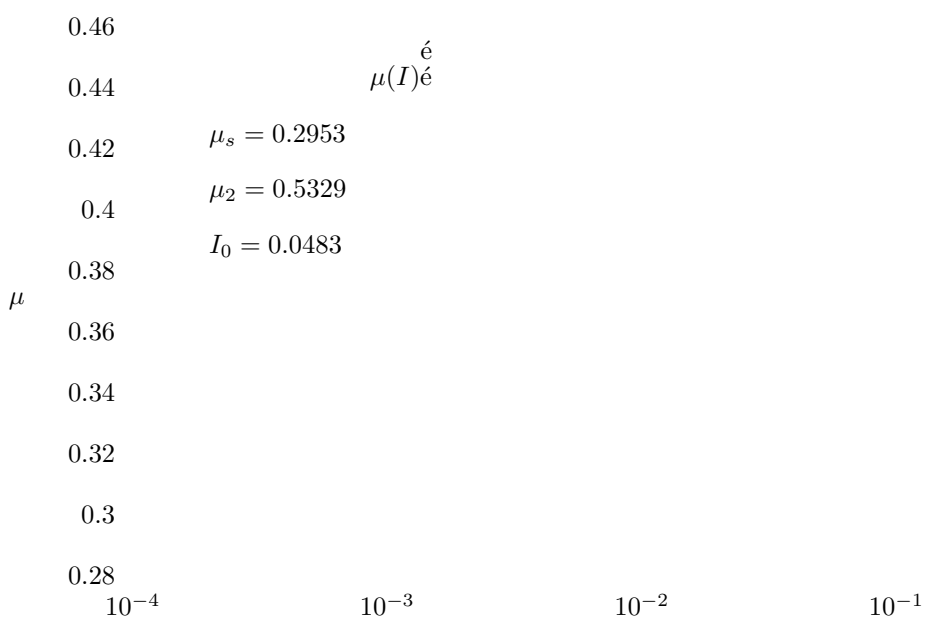
$$I = \dot{\varepsilon} \times \sqrt{\frac{m}{\sigma_{33} \times \bar{a}}} = \dot{\varepsilon} \times \sqrt{\frac{\frac{4}{3}\pi\frac{\bar{a}^3}{8} \times \rho_s}{\sigma_{33} \times \bar{a}}} = \dot{\varepsilon} \times \sqrt{\frac{\pi}{6}} \sqrt{\frac{\bar{a}^2 \rho_s}{\sigma_{33}}} = \sqrt{\frac{\pi}{6}} \times \frac{\dot{\varepsilon} \cdot \bar{a}}{\sqrt{\sigma_{33}/\rho_s}}$$

$$\mu = \tan(\varphi)$$

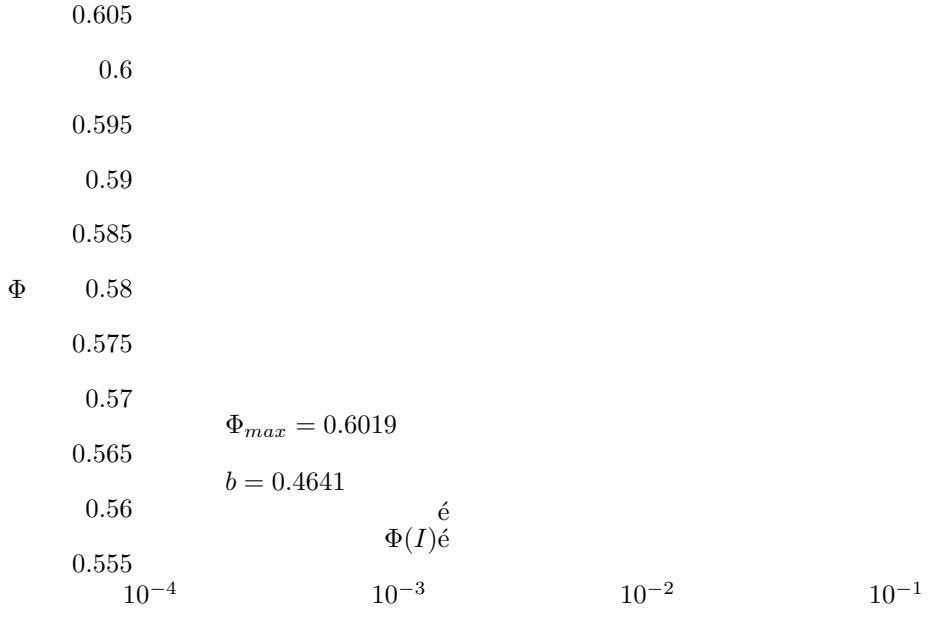
$$\mu(I) = \mu_s + \frac{\mu_2 - \mu_s}{1 + \frac{I_0}{I}}$$

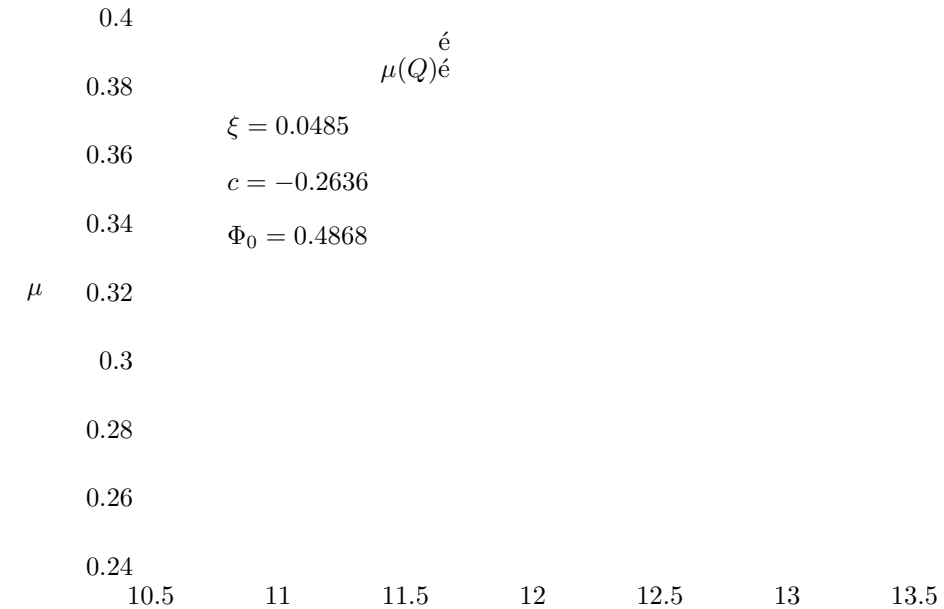
$$\Phi(I) = \Phi^{\max} - bI$$

$\mu_s, \mu_2, I_0, \Phi_{\max}, b$



$\mu(I)$ $\varepsilon_{yy} =$ 70%




0.4
é
$\mu(Q)$é
0.38
$\xi = 0.0485$
0.36
$c = -0.2636$
0.34
$\Phi_0 = 0.4868$
μ
0.32
0.3
0.28
0.26
0.24
10.5
11
11.5
12
12.5
13
13.5
Q

$\mu(Q)$
$Q =$
$f(\Phi_0, I)$