Experiment 2: Uniaxial Compression Test

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AIM:
The objective of this experiment is to determine the machine compliance , the compressive flow strength at ~30% strain of Aluminium sample, Young's modulus in compression and the complete true stress vs. true strain curve

2.Theory/Background (related to the experiments):
The stress-strain relationship of a linear, isotropic material can be determined through tension, compression, or torsion tests. In a compression test, the material is shortened in the direction of the applied force and expands in the direction perpendicular to it.The goal of the compression test is to determine the behavior of the material under compressive load by measuring variables such as stress, strain, and deformation. This test can be used to find the compressive strength, yield strength, ultimate strength, elastic limit, and elastic modulus of the material. Stiffness is a measure of a material's resistance to deformation or deflection under an applied force. The reciprocal of stiffness is called compliance. Compliance can be determined by subtracting the sample's compliance from the system's compliance.

Formulas involved :

Compilance C = $\frac{1}{k}$ for a spring system in series= $\frac{1}{keq} = \frac{1}{k1} + \frac{1}{k2}$

Csystem =Cmachine + Csample Csystem = $\frac{1}{slope\ of\ F\ vs\ s\ graph}$

Csteel = $\frac{1}{k} = \frac{Lsteel}{Asteel * Esteel}$

3. Apparatus Required:
a)The Universal Testing Machine with compression platens
b)Vernier Calipers
c)Specimens (steel – known properties and aluminium – unknown properties)

4. Experimental Method:
(a) Measure the height and diameter of steel specimens using vernier calliper
(b) Mount the platens on the top and bottom ends of UTM machine
(c) Apply grease on both sides of the specimen and place it above the lower platen
(d)Lower the crosshead using the console on the machine until it just touches the specimen(0 load)
(e) Set the parameters in the software and extract the true load vs machine extension data
(f) Repeat the above steps for aluminium specimen
(g) Update the parameters for aluminium specimens in the software and comparev the results with that of steel and use the data extracted to obtain machine compliance

5.Expected outcomes:
(a) Determine the machine compliance of the materials and extract information for a complete representation of the stress-strain relationship
(b) Determine the Youngs modulus in compression and complete true stress vs strain curve for both specimens
(c)Obtain a comparatative analysis on behaviour of aluminium and steel specimens under compression