

# Aluminum foams as permanent cores in casting

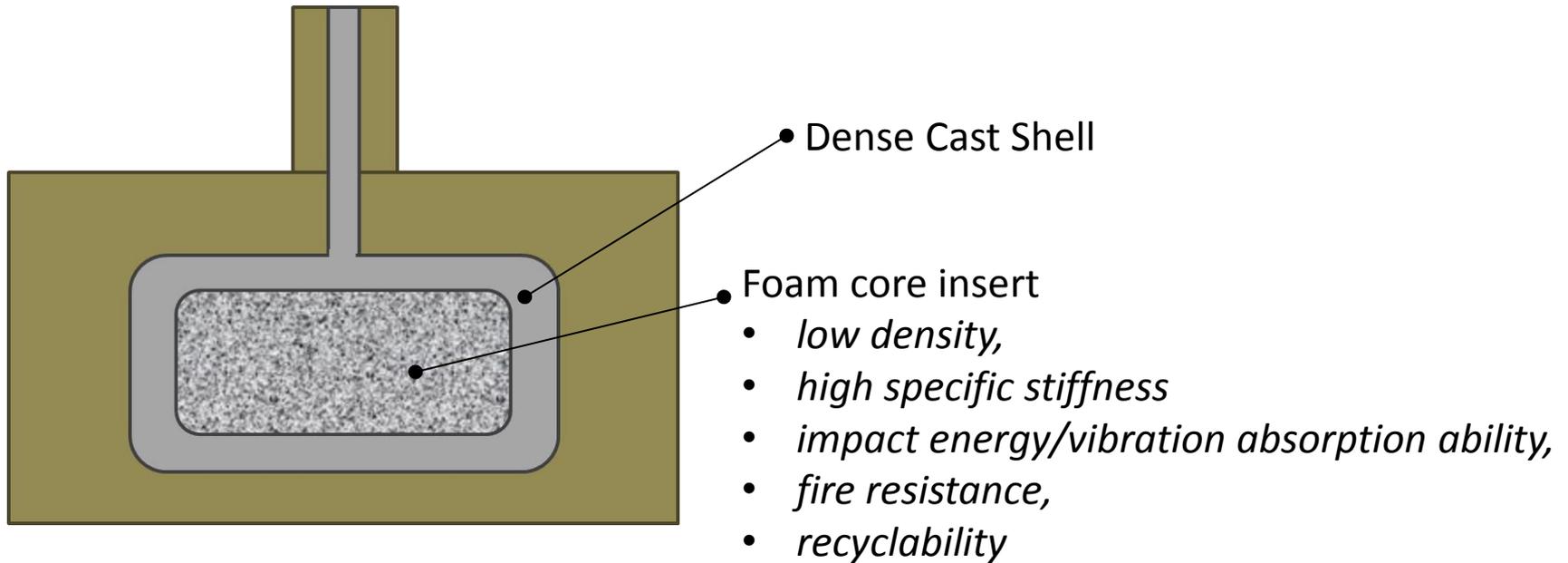
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# Aluminum foams as permanent cores in casting: the rationale



## Advantages

- ✓ Weight reduction vs dense components
- ✓ Obtainment of «cavities» in casting objects
- ✓ Strength increase vs hollow or T-shaped sections
- ✓ Impact energy and vibration absorption
- ✓ Acoustic insulation
- ✓ Recyclability
- ✓ No removal/recycling of traditional sand cores

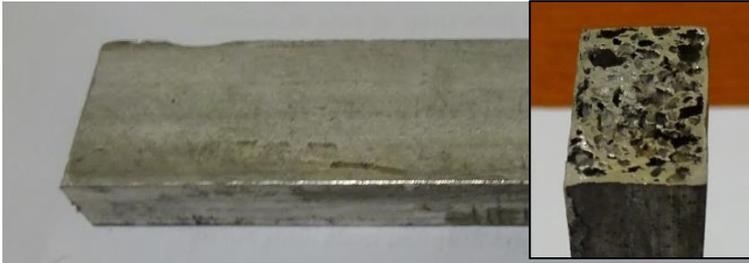
## Main Issues

- Poor core-shell bonding
- Poor foam resistance to casting condition
- Lack of knowledge on the topic

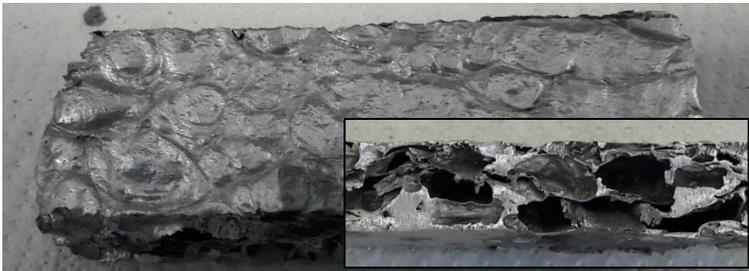
# Aluminum foams as permanent cores in casting: experimental

## Foam Inserts

AF1: foams with a dense and thick outer skin

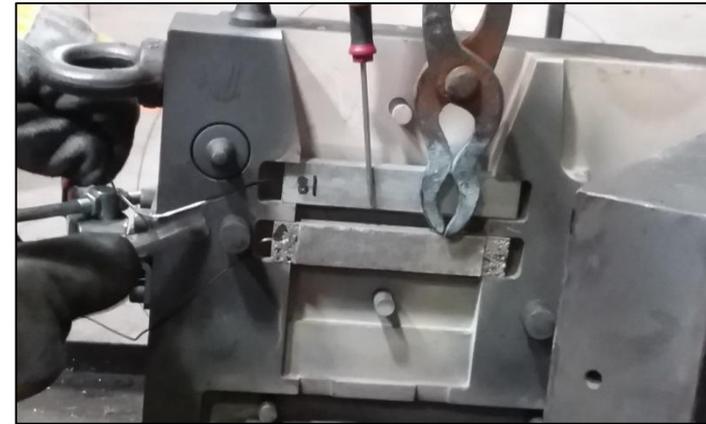


AF»: foams with thin and not completely homogeneous outer skin



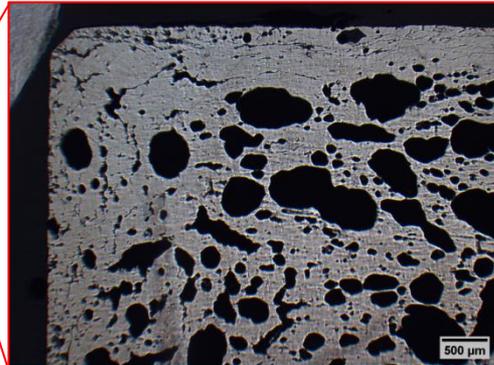
## Gravity casting experiments

Cast alloy: Al-Si-Cu-Mg alloy (EN AB-46400).

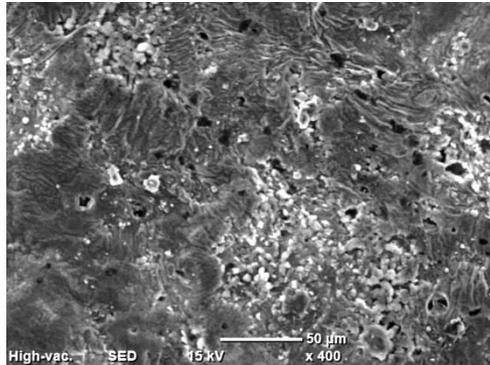


# Aluminum foams as permanent cores in casting: results (1)

AF1

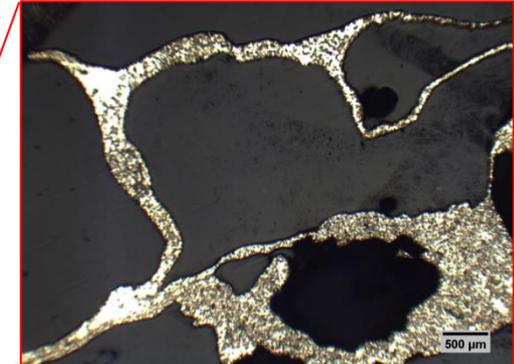
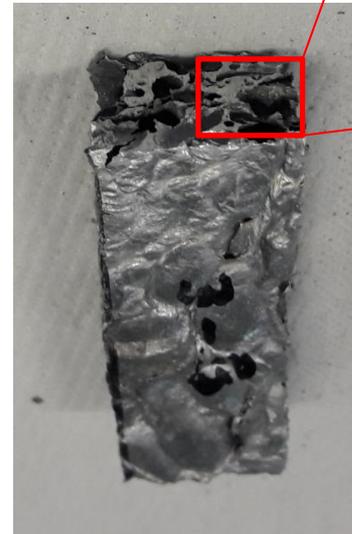


*Thick skin (up to 1200 μm), relative density 0,4-0,6*

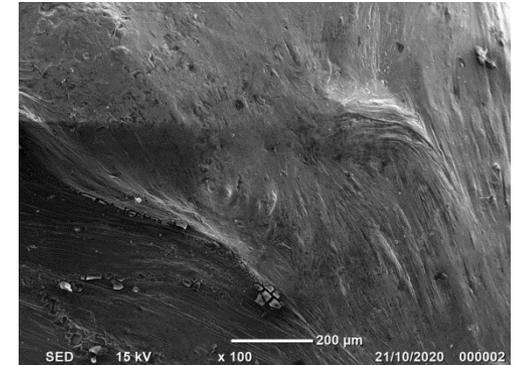


*Outer skin rich in well adhered Mg oxides/carbonates*

AF2



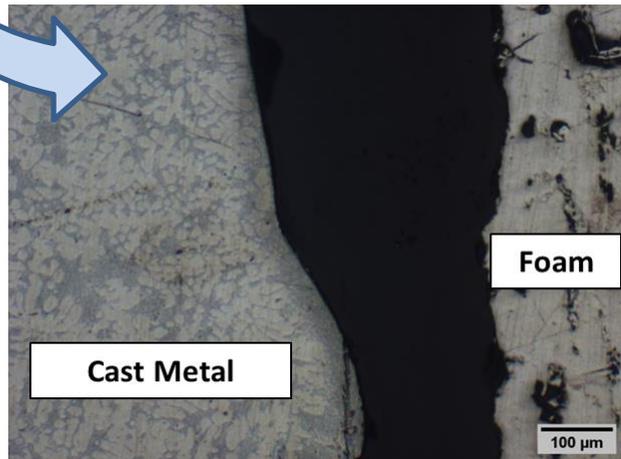
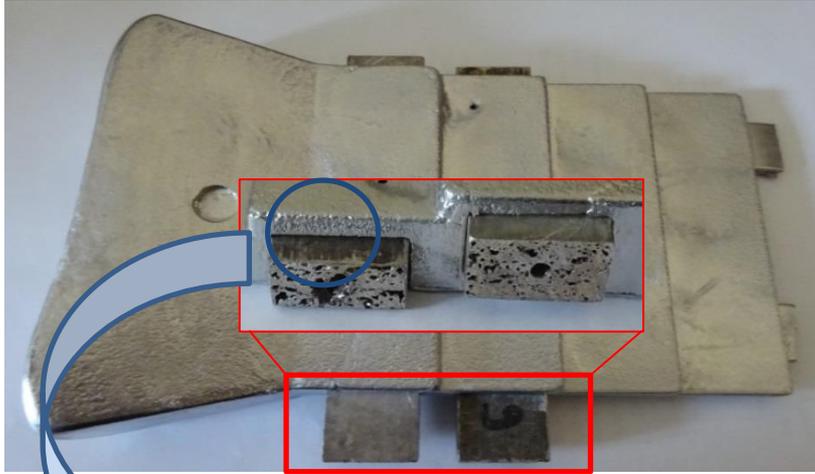
*Thin skin (up to 300μm), relative density 0,1-0,2*



*Outer skin almost free from oxides/carbonates*

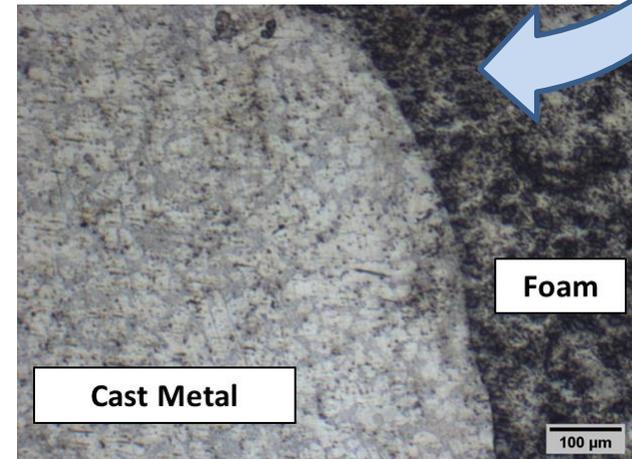
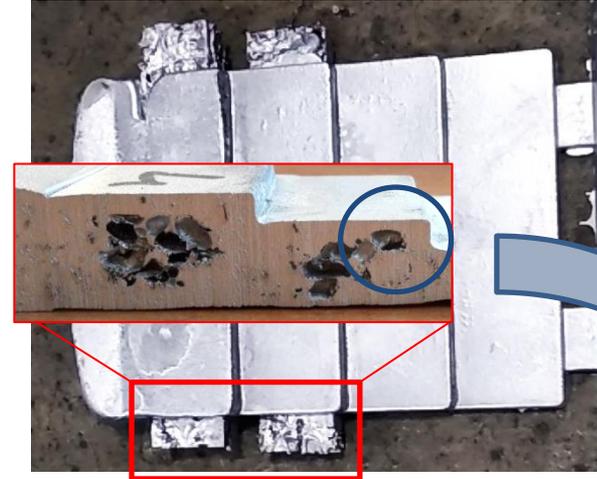
# Aluminum foams as permanent cores in casting: results (2)

AF1 as core in Al-Si-Cu-Mg alloy cast



- *No core infiltration (maintenance of shape and porosity)*
- *Core shell gap (no bonding)*

AF2 as core in Al-Si-Cu-Mg alloy cast



- *Partial core infiltration (partial maintenance of porosity)*
- *Core metallurgical bonding*

# Aluminum foams as permanent cores in casting: conclusions

- Foams with thick and continuous outer skin on the whole external surface are effectively protected by infiltration of molten metal and maintain their shape and porosity.
- Foams with a thin, non homogeneous and not continuous (on the whole core surface) outer skin are partially infiltrated by molten metal during casting, losing part of the porosity.
- High surface oxidation of the outer skin inhibits its reaction with molten metal hampering metallurgical bonding between the foam core and cast metal.
- When the outer skin is less oxidized metallurgical continuity between the foam core and the cast shell can be obtained.

# Aluminum foams as permanent cores in casting: future perspectives

- Proper surface treatments (e.g. etching and/or coating) can be developed in order to prepare the outer thick skin (if it is highly oxidized) before insertion in casting.
- Foams with an outer skin on all the core faces exposed to the molten metal and sufficiently thick should be used as cores in casting

