ALE_STRUCTURED_MULTI-MATERIAL_GROUP_*{OPTION}

Purpose: Specify the material properties of each ALE multi-material group (AMMG) used by the S-ALE solver. Each AMMG represents one unique "fluid" which flows in the S-ALE mesh.

Available options include:

<BLANK>

PLNEPS

AXISYM

<BLANK> option is for S-ALE 3D simulations. The PLNEPS and AXISYM options are used in S-ALE 2D simulations to setup plane strain and axisymmetric element formulations. They are corresponding to ELFORM=13 and ELFROM=14 in *SECTION_ALE2D, respectively.

To set up a typical Structured ALE (S-ALE) simulation, you construct the S-ALE mesh with*ALE_STRUCTURED_MESH. The mesh includes a set of hex solid elements and their nodes. You specify the ALE material properties with *ALE_STRUCTURED_MULTI-MATERIAL_GROUP. *ALE_STRUCTURED_MESH_VOLUME_FILLING fills the domain with these AMMGs.

> **NOTE:** You can use *ALE_MULTI-MATERIAL_GROUP to specify the AMMGs. However, this keyword provides a simpler interface since you specify the material and EOS here instead of needing a separate part ID. This keyword also allows you to give each AMMG a name and reference pressure (see Remarks 2 and 3).

Card 1	1	2	3	4	5	6	7	8
Variable	AMMGNM	MID	EOSID					PREF
Type	A	I	I					F
Default	none	none	none					0.

VARIABLE	DESCRIPTION
AMMGNM	AMMG name. This name is required to identify the AMMG (S-ALE fluid). It is not case sensitive, but it needs to be unique. See Remark 2.
MID	Material ID

VARIABLE	DESCRIPTION
EOSID	Equation-of-state ID
PREF	Reference pressure of this AMMG. See Remark 3.

Remarks:

1. **AMMGID.** Each AMMG is automatically assigned an ID (AMMGID) according to its order of appearance in the input deck. The AMMG defined in the first line has an AMMGID = 1, the second line AMMGID = 2, so on and so forth. This ID later could be used in other keyword cards, such as *SET_MULTI-MATERIAL_GROUP. The general ALE solver uses this convention which is inherited by the S-ALE solver.

2. **AMMG NAME.** Traditionally keywords refer to ALE multi-materials with their AMMGIDs. This ID is automatically assigned based on the order of appearance of each AMMG as discussed in Remark 1. This arrangement works in most cases but has its problems. For example, if you want to switch the order of the AMMGs or want to add or remove certain AMMGs, all references to those AMMGs are affected and need to be modified/corrected. Fixing those references is often forgotten, leading to errors.

   The name specified with AMMGNM on this keyword provides an alternative way to refer to AMMGs. Other ALE keyword cards, such as *SET_MULTI-MATERIAL_GROUP, accept it in place of AMMGID for S-ALE simulations. For example, suppose the third AMMG defined with *ALE_STRUCTURED_MULTI-MATERIAL_GROUP has AMMGNM = air. In the other keywords, we could either input 3 or air where it asks for AMMGID.

   We recommend using AMMGNM over AMMGID as it is more user-friendly and less error prone.

3. **PREF.** PREF allows you to provide different reference pressures for each AMMG. With this, we can handle mismatched reference pressures among different AMMGs.

   Each ALE material definition (*MAT +*EOS) has an implicit reference pressure. Different AMMGs in the same model are generally required to have the same reference pressure. For example, assume we have two AMMGs, air and water. For the *EOS, we need to carefully choose E0 and V0 values so that their initial pressure matches this reference pressure, most likely atmospheric pressure.

   Sometimes mismatch could happen. For example, air and high explosive may have different reference pressures. Air may have a reference pressure of 1 bar, but the high explosive defined with *EOS_JWL may have a reference pressure of 0 bar. Before PREF, this discrepancy was considered small and ignored. PREF resolves this discrepancy by allowing us to input 101325.0 as PREF for air and 0.0 as PREF for high explosive. Then, when force is evaluated for an element, this PREF pressure will be subtracted off from that of the corresponding material.