Summary of Invention

Technical Problem

[0004]

As disclosed in PTL 1, in order to suppress agglomeration in a CFB boiler, additives such as calcium carbonate and dolomite have been supplied to the combustion chamber. However, the mechanism and conditions under which agglomeration occurs in the CFB boiler have not been fully elucidated, and it has been difficult to appropriately determine the supply timing, the supply amount, the supply manner, and the like of additives.

[0005]

Embodiments of the present invention provide a combustion device and the like that can effectively suppress the occurrence of agglomeration.

Solution to Problem

[0006]

According to a first aspect of the present invention, there is provided a combustion device that supplies a fuel into a combustion chamber in which a fluid material containing silica flows and that combusts the fuel, the combustion device including: an earth metal supply unit that supplies an alkaline earth metal and/or an earth metal such that a ratio of the alkaline earth metal and/or the earth metal to an alkali metal in the combustion chamber exceeds a predetermined lower limit; and a fluid material supply unit that supplies the fluid material to which the

alkaline earth metal and/or the earth metal supplied by the earth metal supply unit has been added into the combustion chamber.

[0007]

As will be described later, as a result of tests in an actual CFB boiler, it was found that the occurrence of agglomeration may be related to a ratio (hereinafter also referred to as a metal ratio) of alkaline earth metals (magnesium, calcium, and the like) and/or earth metals (aluminum and the like) to alkali metals (sodium, potassium, and the like) in the combustion chamber. In the present aspect, therefore, the occurrence of agglomeration is effectively suppressed by supplying alkaline earth metals and/or earth metals such that the metal ratio in the combustion chamber exceeds a predetermined lower limit.

[0008]

According to a second aspect of the present invention, there is provided a combustion method. The method is executed in a combustion device that supplies a fuel into a combustion chamber in which a fluid material containing silica flows and that combusts the fuel, and includes: an earth metal supply step of supplying an alkaline earth metal and/or an earth metal such that a ratio of the alkaline earth metal and/or the earth metal to an alkali metal in the combustion chamber exceeds a predetermined lower limit; and a fluid material supply step of supplying the fluid material to which the alkaline earth metal and/or the earth metal supplied in the earth metal supply step has been added into the combustion chamber.

[0008a]

According to third aspect of the present invention, there is provided a combustion program causing a computer to execute the following steps in a combustion device that supplies a fuel into a combustion chamber in which a fluid material containing silica flows and that combusts the fuel, the steps including: an earth metal supply step of supplying an alkaline earth metal and/or an earth metal such that a ratio of the alkaline earth metal and/or the earth metal to an alkali metal in the combustion chamber exceeds a predetermined lower limit; and a fluid material supply step of supplying the fluid material to which the alkaline earth metal and/or the earth metal supplied in the earth metal supply step has been added into the combustion chamber.

[0009]

Any combination of the above components, or any expression of these components converted into methods, devices, systems, recording media, computer programs, or the like, are also included in the present invention.

Advantageous Effects of Invention

[0010]

According to embodiments of the present invention, the occurrence of agglomeration can be effectively suppressed.

Brief Description of Drawings

[0011]

Fig. 1 schematically illustrates a CFB boiler.

“Ca/K” increases, the melting point of the eutectic system increases, entering the upper solid phase region in the state diagram of Fig. 2, making it difficult for agglomeration to occur.

[0039]

Based on the above considerations and/or hypotheses, the agglomeration suppression device 8 in Fig. 1 includes a metal ratio estimation unit 83 that estimates the metal ratio ([Mg, Ca, Al]/[Na, K] and the like) of alkaline earth metals (Mg, Ca, and the like) and/or earth metals (Al, and the like) to alkali metals (Na, K, and the like) in the furnace 11.

[0040]

The metal ratio estimation unit 83 may directly measure a metal ratio such as “Ca/K” in the furnace 11, but it is practically difficult to measure in the high-temperature furnace 11. Therefore, the metal ratio estimation unit 83 estimates a metal ratio such as “Ca/K” based on the measurement results of the combustion ash measurement unit 81 and/or component information acquired by the fuel component information acquisition unit 82.

[0041]

The combustion ash measurement unit 81 measures the combustion ash generated by combustion in the furnace 11 continuously or intermittently (for example, several times