[0006]

Patent Literature 1: Japanese Patent Application Laid-Open (JP-A) No. 2021-084852

Patent Literature 2: JP-A No. 2019-169317

Patent Literature 3: JP-A No. 2010-265125

Patent Literature 4: JP-A No. 2007-220414

[0007]

To achieve high power generation performance (efficiency point performance) in a low current density range, a carbon support needs to have a three-dimensional pore structure.

In the prior art, the average primary particle diameter, average pore diameter, pore volume of carbon are defined. However, definitions of the carbon wall content by nitrogen adsorption, the carbon support ratio by 3D-TEM, the average diameter of the throats of the pore, and the like are not done, and the power generation performance of fuel cells is sometimes insufficient in the prior art.

SUMMARY

[0008]

The disclosure was achieved in light of the above circumstances. This disclosure provides a carbon support for catalysts for fuel cells, which increases the power generation performance of fuel cells, a catalyst for fuel cells, a catalyst layer for fuel cells, and a method for producing the carbon support.

[0009]

In one aspect, the carbon support of the present disclosure is a carbon support for catalysts for fuel cells,

wherein the carbon support includes at least one pore;

wherein a thickness of a carbon wall of the carbon support, which is derived from a three-dimensional pore structure of a silica mold obtained by pore volume measurement

of the silica mold by nitrogen adsorption analysis, is 3.3 nm or more and 11.2 nm or less; and

wherein a carbon wall content is more than 60.3 ml/g and less than 190.8 ml/g.

[0010]

In one example, a carbon support ratio calculated by 3D-TEM observation may be more than 36% and less than 67%.

[0011]

In another example, the carbon support may include at least one throat in the pore, and an average diameter of the at least one throat of the pore, which is calculated by 3D-TEM observation, may be 1.9 nm or more and less than 2.5 nm.

[0012]

In another example, the carbon wall content may be 61.5 ml/g or more and 168.4 ml/g or less; the carbon support ratio may be 46% or more and 57% or less; and the average diameter of the at least one throat of the pore may be 1.9 nm or more and 2.0 nm or less.

[0013]

In another example, the catalyst for fuel cells according to the present disclosure, is a catalyst for fuel cells, wherein the catalyst comprises a carbon support supporting a metal catalyst, and wherein the carbon support is the above-described carbon support.

[0014]

In another example, the catalyst layer for fuel cells according to the present disclosure, is a catalyst layer for fuel cells, wherein the catalyst layer comprises the above-described catalyst for fuel cells.

[0015]

In another example, the carbon support production method of the present disclosure is a method for producing the above-described carbon support, wherein a silica including at least

one pore is produced