Transition metal dichalcogenides (TMDs) are emerged as atomically-thin building blocks with unique properties, including photo-luminescence, bandgap tunability, high mobility, low surface scattering, to name but a few, and thus driving the enthusiasm of the community. Here we review the alternatives offered by scanning probe microscopies (SPM) for TMDs. After introducing the main methods available, we focus on the direct sensing of different defects and their impact on electrical device characteristics. We report on different options for correlative analysis that address variability and reliability issues in devices, while studying local materials properties of TMDs at relevant scales.